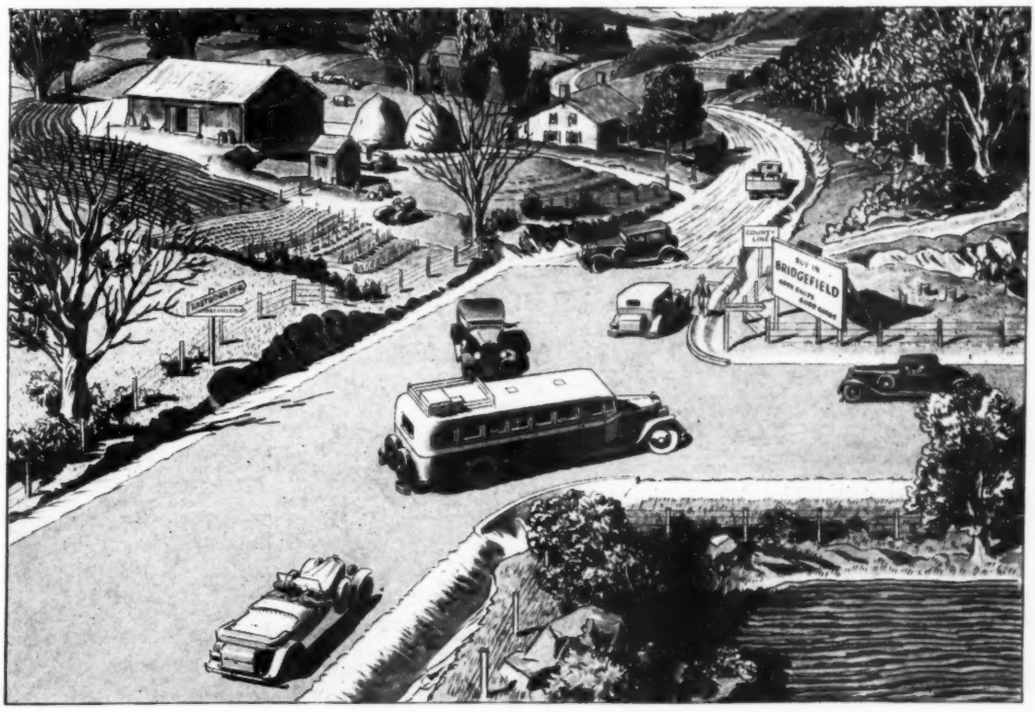
OCT 1 - 1931

PUBLIC WORKS

CITY COUNTY STATE

To Wait is to Pay *at least* Twice !



If you need a good road, you keep on paying for the poor one in innumerable ways until the good road is built.

POSTPONING needed road improvement merely increases the number of ways you will eventually have to pay. Poor roads save no one money, or time. There is no calculating what they cost farmers and rural business in lost profit and opportunity.

Take advantage of the few remaining weeks before Winter sets in. Whether you have a road to surface or widen or patching to be done, there is always a fast and economical way to do it with Tarvia.

Tarvia economy embraces first cost, speed of completion and low upkeep.

The Barrett Company's unmatched facilties for prompt deliveries and dependable service are ready to help you. Phone, wire or write our nearest office.

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	Hartford	

IN CANADA:

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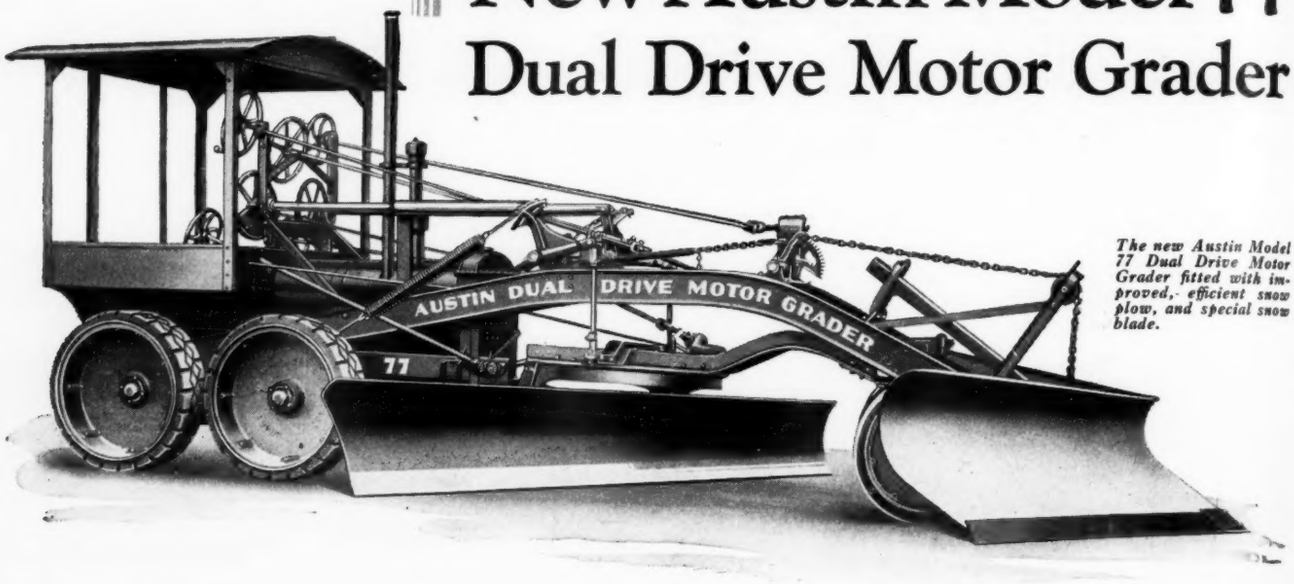
OCTOBER, 1931

Announcing the

New Austin Model 77 Dual Drive Motor Grader

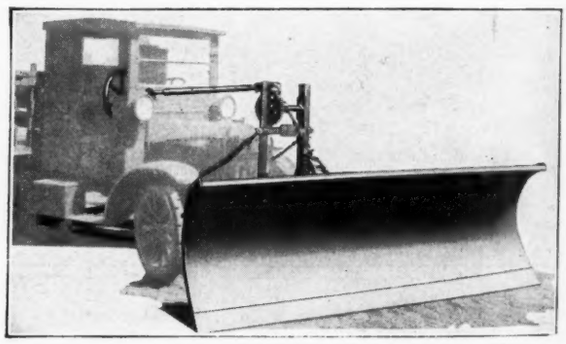


The new Austin Model 77 Dual Drive Motor Grader fitted with improved, efficient snow plow, and special snow blade.

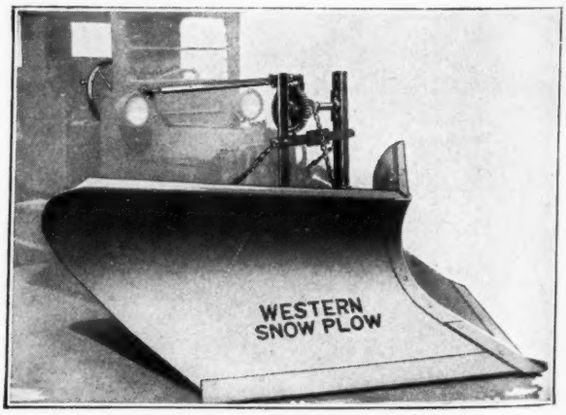
6 cylinder, 40 hp. motor and unique driving mechanism are outstanding features of the new Austin model . . .

Greater power, improved traction, freedom from skidding and miring, easy steering — these are notable contributions that the Austin Dual Drive has made to motor grader performance. And now—with the new Austin Model 77—even greater efficiency, dependability and year 'round serviceability are offered to road machinery users.

The Austin Model 77 has *more* power. Ample power to buck the heaviest snow drifts. Power to carry on through tough going that balks other graders. The full efficiency of the rugged 6-cylinder, 40-hp. motor is utilized by the improved Austin drive mechanism that carries power to the four drive wheels. Each of these four wheels hugs the ground and does its full share of work. Because of the "floating" construction, only 50 per cent of any up and down movement of the drive wheels is transmitted to the frame and blade. Therefore the Austin Model 77 does a *smoother* job than any other type of grader. Furnished with snow plow attachments if desired. For complete information write the Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago. Branches in principal cities.



The Western 30-inch straight-blade plow with 6-inch extension.



The Western V-type snowplow. Furnished with or without wings.

Roads and streets can best be kept open throughout the winter by cleaning away the snow as it falls. Western Snow Plows attached to motor trucks will do this essential job, quickly, efficiently, and at lowest cost. They are made in both the straight blade and V-shaped types each interchangeable with the other. Complete information will be sent upon request.

Austin-Western
ROAD MACHINERY

VOL. 62 No. 10
Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879,
Published Monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
Subscription price $3.00 a year. Single copies 35 cents.

SAND, soft SOIL, SILT

★ ★ ★

WHAT else but a track-type tractor could keep going in this sand? What else but a "Caterpillar" could turn in a record of low up-keep? Here a 70-ft. cut is being made on Indiana State Highway No. 20. An Ateco 4-yd. Scraper is used for leveling and to pull the sand down to the shovel. In any soil — in any weather — "Caterpillar"!

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Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

Prices — f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
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SIXTY	$4175		

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TRACTOR

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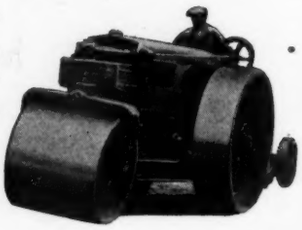
Buffalo Springfield

How well those responsible for the design and fabrication of

Buffalo-Springfield ROLLERS

have wrought is evidenced by the fact that there are more Buffalo-Springfields on the roads and streets of America, both on maintenance and new construction, than all other builders of such equipment can account for.

Built in all practical weights and sizes, three wheel and tandem. Steam and motor driven. Scarifier and other attachments optional.



Write for illustrated literature describing entire line

The Buffalo-Springfield Roller Co.
SPRINGFIELD, OHIO

Unemployment Relief by Cities

Unemployment can be relieved, if not entirely eliminated, by public work. Many, from the President down, have said so—Grand Rapids, Indianapolis and other cities have proved it.

There are two problems—finding the work and finding the money. Most have thought the former the more difficult, but Indianapolis has found a great abundance of work for 500 to 1700 men that is "useful and beneficial to the community, but does not in any way conflict with regular or imminent plans involving the employment of men in the customary way;" while Grand Rapids has 2,000 men busy building many of the things that she has wanted for a long time.

In Indianpolis "Roadways have been cleaned, repaired or built; park areas cleared of underbrush or dead wood, sodded and planted; unsightly spots about other public areas cleaned and landscaped. . . . . cleaning, straightening and beautifying the beds and banks of small streams that had been transformed from beautiful little brooks to public catch-alls for trash." Also sweeping down-town sidewalks, beautifying the city hospital grounds, cutting back curbs at street intersections, etc.

Grand Rapids has used this labor for creating a new park, widening and extending streets, building new sidewalks, rounding street corners, laying water mains and sewers, cutting wood at the city wood pile, filling in city lots, painting city buildings, constructing a swimming pool, "and a hundred and one other things which various city officials have on their books." Because of this work, "Grand Rapids, always a city of pleasing appearance, is rapidly becoming one of the most attractive cities in the country, a city free from drabness."

As to the efficiency of this labor, Indianapolis reports that "the testimony of department heads making use of this labor is that it is as efficient as ordinary public department labor." Grand Rapids finds that "for every dollar the city spends in public relief, Grand Rapids gets 80 cents in labor on public improvements."

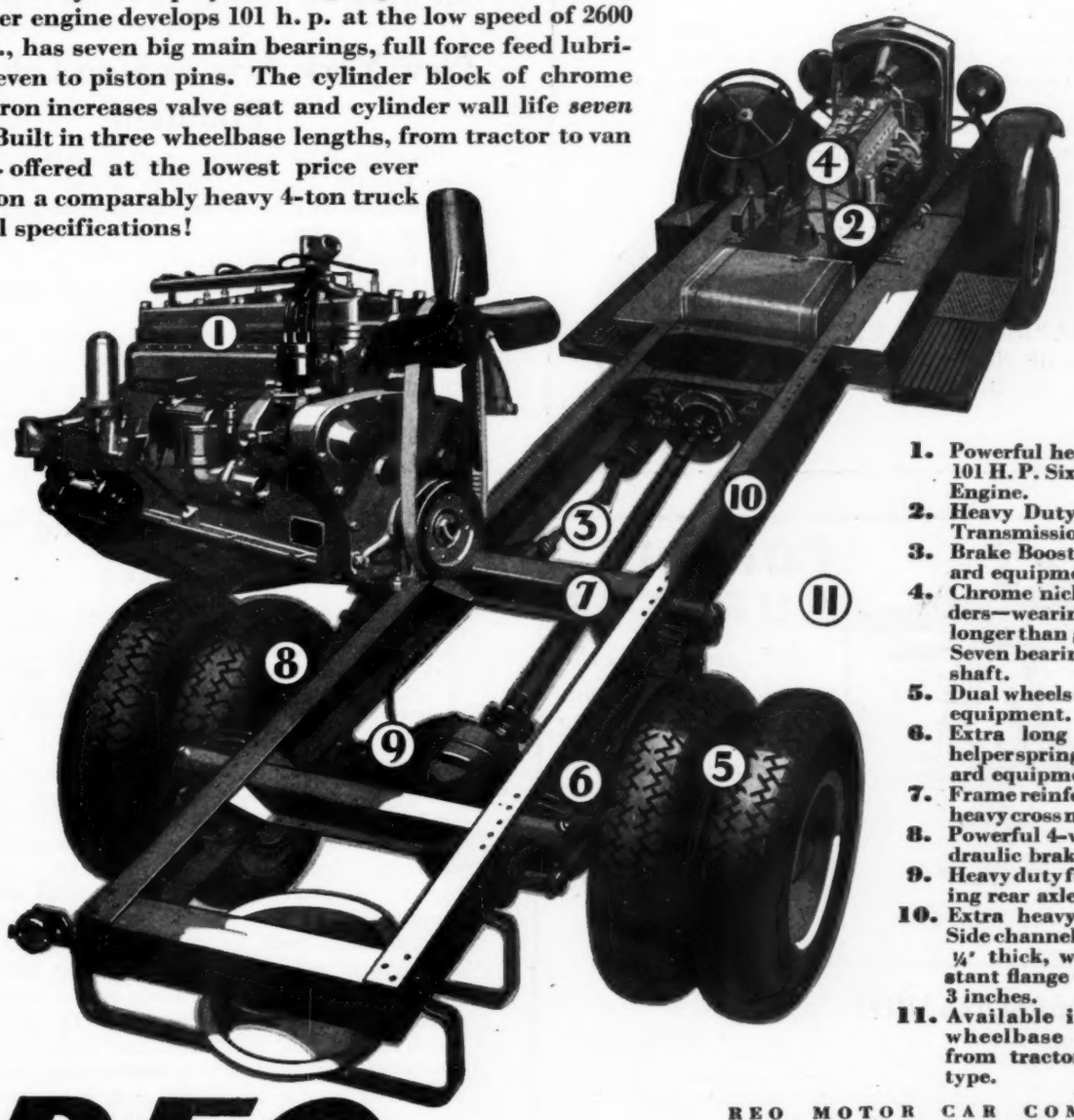
Neither of these cities pays this labor at regular labor union rates. The pay is made small so that the applicant will never be content to keep at this work if other becomes available. Indianapolis pays 30 cents an hour for eight hours a day for three days a week, part of this being paid in the form of relief given to the laborers by the town and the balance in cash. Last summer the cash gave out and the work was cut down to two days a week, all paid in direct relief, but it is hoped that three days with one-third cash payment can be renewed this winter. Indianapolis obtains its money from the Community Fund and the public relief agencies—the township trustees.

Grand Rapids pays its emergency men 40 cents an hour, but in scrip, good only at a store operated by the city, where all necessities can be obtained at low prices. The men work in half-day shifts, men with large families every day and those with small families from two half-days up; while men without dependents are housed in the city's social center and work less. The scrip plan simplifies transference of food and clothing and lessens foolish spending and fraud, and is generally approved by the merchants. Funds for relief are raised by a ¼ of one percent tax on property instead of voluntary contributions.

THE NEW REO BIG 4 TONNER

A Truck Built to Do YOUR Job

The new Reo Big Four-Tonner is a heavy truck for heavy work, massively constructed at all vital points. It is engineered for *safe* and *profitable* high-speed travel. The Big 4-Tonner engine develops 101 h. p. at the low speed of 2600 R. P. M., has seven big main bearings, full force feed lubrication even to piston pins. The cylinder block of chrome nickel iron increases valve seat and cylinder wall life *seven times*. Built in three wheelbase lengths, from tractor to van types — offered at the lowest price ever placed on a comparably heavy 4-ton truck of equal specifications!



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2. Heavy Duty 4-speed Transmission.
3. Brake Booster standard equipment.
4. Chrome nickel cylinders—wearing 7 times longer than grey iron. Seven bearing crankshaft.
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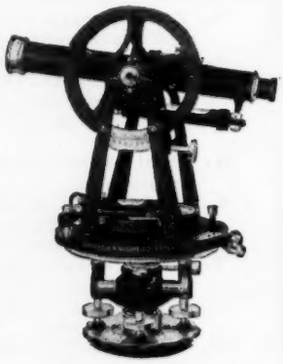

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Features in Swimming Pool Design

A swimming pool near Peekskill, N. Y., recently reconstructed, contains many up-to-date features in design. It is oval in shape, about 210 feet long and 50 to 55 feet wide, with a capacity of 220,000 gallons. Water, pumped from the Hudson river, is filtered, chlorinated and recirculated with equipment capable of treating the volume of the pool three times in 24 hours. The inlets are designed to distribute the chlorinated water in proportion to the volumes at the various parts of the pool. There are two inlets at the shallow end which is but twelve inches deep and four more inlets spaced in pairs at intervals of seventy feet along the bottom. Sixty per cent of the pool area is less than three and one-half feet in depth, as the pool is designed primarily for the use of children.

New York Acts to Stop Lake Erie Pollution

Progress in the elimination of the pollution of Lake Erie and the Niagara river by sewage from Buffalo and neighboring municipalities is indicated as a result of a hearing held at Albany, N. Y., July 10. The State has embarked on a five-year program for the elimination of the pollution of streams by sewage from state institutions and the State wishes Buffalo and the other eight cities and villages involved to submit positive evidence of plans to end the contamination of Lake Erie, its tributaries and the Niagara river by untreated sewage. These communities were asked by Governor Roosevelt to submit to him plans for sewage disposal by November 1, 1931.

Engineering Work Done by the Red Cross

The 1931 "Roll Call" of the American Red Cross takes place from Armistice Day, November 11, to November 26. In asking that we urge engineers to interest themselves in the work, at least to the extent of enrolling, the national director of roll call, Douglas Greisemer, cites some instances of aid rendered along engineering lines, among which the following seem especially interesting.

In connection with the rehabilitation program following the Mississippi Valley flood of 1927, in some instances whole towns were moved. Columbus, Ky., a town of 600 inhabitants on the bank of the Mississippi, had been flooded almost every year and the Red Cross, after conference with local officials and property owners, moved the town bodily to a bluff one-half mile from its original site, a city planner having first zoned the new city limits, laid out business blocks, sites for churches and a school, parks, streets and a residential section. The new site was purchased by the Red Cross and deeded over to the new Columbus with the understanding that individual deeds would be given each flood sufferer who had owned property in the old town.

Carrville, S. C., a village of 100 population, was moved for the same reason. In that instance, the property between the old site and the new location was obstructed, preventing bodily transfer of the buildings, but they were torn down, moved as lumber or sections, and rebuilt in duplicate of the original community.

It also was after the Mississippi flood that the Red Cross literally dug a town, Melville, La., out of the earth and debris. Every home in this incorpo-

MEASURE YOUR CLAMSHELL BUCKET ON ITS DAY-BY-DAY EARNING CAPACITY

Base your conclusions on its ability as a producing worker

The clamshell bucket that pays best is the bucket that always does "a bigger day's work"—*That's an Owen!*

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A sound investment in all respects—with bigger and better returns not only assured—but guaranteed. *That's an Owen!*

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OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK

Owen Buckets

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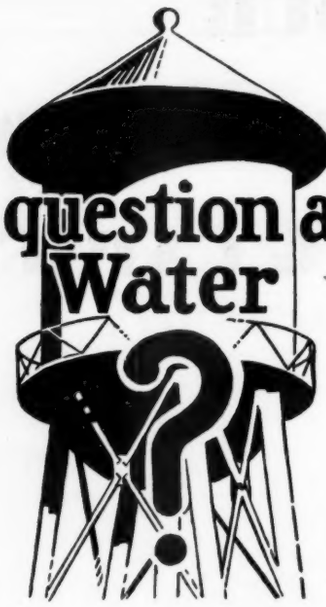
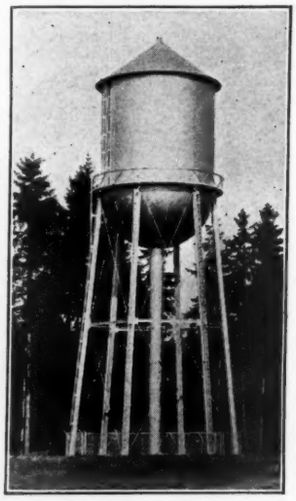


Two "Pittsburgh-Des Moines" tanks of 250,000 gallons capacity—500,000 gallons total—have just been completed this summer for the City of Olympia, Washington. The photograph shows the south tank — diameter 32 feet, 106 feet to upper water level and 74 feet 6 inches to the balcony.



The other tank, erected on the east side of the city, also has a diameter of 32 feet and stands on a slightly lower steel tower, 85 feet to the water level and 53 feet 10 inches to the balcony.

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PITTSBURGH DES MOINES

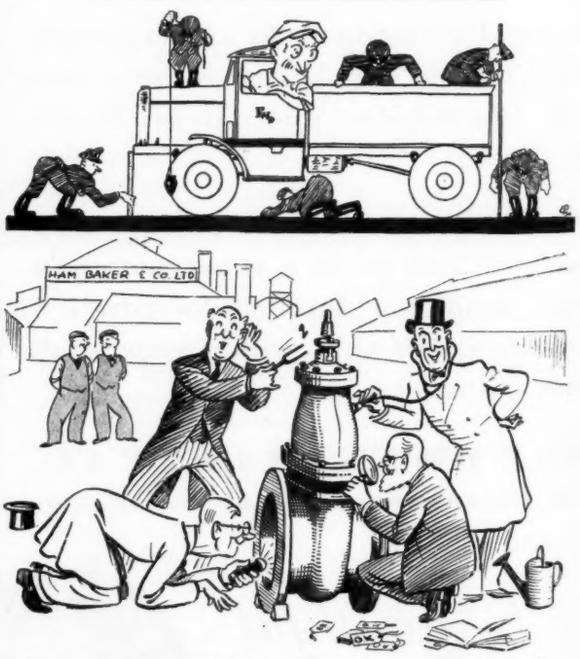
When writing, please mention PUBLIC WORKS

rated community of 1,394 inhabitants was flooded, the water washing away a number of houses and shifting others from their foundations, while sand buried them to a depth of 3 to 9 feet. For almost nine weeks the buildings were 12 feet or more under water; the water, light and drainage systems were destroyed. The town government had practically no funds, and the Red Cross, cooperating with the town and the state highway commission, removed 31,000 cubic feet of sand from the streets, built and repaired ditches and canals and small bridges, built 21 new houses and raised, moved or repaired 312.

Cement Use, by States, in 1931

Portland cement is used so generally in construction work nowadays that probably it is a better index of the amount of construction going on than any other material; although steel may be a better index for building construction. The figures of the U. S. Bureau of Mines on Portland cement shipments in 1931 as compared to the same months of 1930 are of special interest from this point of view.

Up to May the shipments had been running a little over 80% of those of the corresponding month of 1930, but June, July and August fell off to a little below 80%. The latest report giving figures by states is for July. Combining the figures for June and July of 1931 and 1930, we find that fifteen states used more cement in 1931 than 1930, as follows: Arizona, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Nebraska, New York, North Carolina, South Carolina, South Dakota, and Virginia. The District of Columbia led with 59%, and Louisiana was next with 52%. The other states all showed more or less falling off, the maximum being Tennessee—52% less, and the next, Vermont—50% less. The average decrease for all the states and District of Columbia for June and July was 21%.



HUMOR IN ENGLISH (BELOW) AND AMERICAN (ABOVE) ADVERTISEMENTS.

Ham Baker & Co. assure water works men that their valves are "all carefully tested before leaving the works;" the upper cut is to assure purchasers of F. W. D. trucks that new laws affecting sizes and weights of vehicles permitted on public highways need cause them no worry.

PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 62 OCTOBER, 1931 NO. 10

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"Uncle Tune Can Take Care of Himself"

Preparations are moving ahead on an impressive scale to provide work for the unemployed this winter. Undoubtedly the national and state governments are obligated to put forth every effort, but in the final analysis the problem must be solved locally. It is nice to talk about $5,000,0000,000 governmental bond issues to solve all our problems, but it's only a pipe dream. We have to solve them ourselves. If there were such a bond issue, who would pay for it? We would. Well, why not do it ourselves for a third or a half the cost?

The able men who are to be found in every locality are best fitted to solve the problems of that locality; to plan the work that will do the most good to the community; to see to it that the community receives honest work, and work of permanent value; and to control the raising and expenditure of funds, and the employment of labor. In this way, money will be conserved, the truly needy will be relieved, and there will be a reasonable return on the money spent. The writer is now cooperating with his home community in this matter, and hopes to be able to report in our next issue what one village is doing in a practical way for its unemployed.

He will also take the liberty of telling some family history, because it applies so well here. His great-grandfather, Teunis, after serving in the war of 1812, settled with his family in the Catskill mountains some 50 miles west of the Hudson river. Supplies came up the river by boat and then were hauled in by ox-teams. Indians were still plentiful, but not especially dangerous.

On one trip for supplies with a neighbor, the neighbor's ox-drawn wagon became stuck in the mud. He appealed to Teunis, commonly called "Uncle Tune," for help. The latter, having partaken the day before somewhat freely of the riverfront firewater had perhaps a slight tendency toward being more than usually religious. He dropped to his knees in the mud puddle and prayed: "Oh, Lord, give me strength to help Brother Edwards out of this mud. Uncle Tune can take care of himself." He put his shoulder to wheel, and Brother Edwards was extricated. Uncle Tune took care of himself, as he had promised.

If every community earnestly puts its shoulder to the wheel of unemployment, meanwhile taking to themselves what is now the family motto, so to speak, of "Uncle Tune can take care of himself," this depression and this unemployment wouldn't last long.

Money may be spent on "doles," "relief," or what have you, but spent that way it won't produce any returns. Spent for needed, permanent, planned public improvements, it will give just the same degree of relief, and, in addition, will prove a first-class investment for any community.

J. T. MORRIS
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Vice-Pres. & Asso. Editor
CROXTON MORRIS
Ass't Manager

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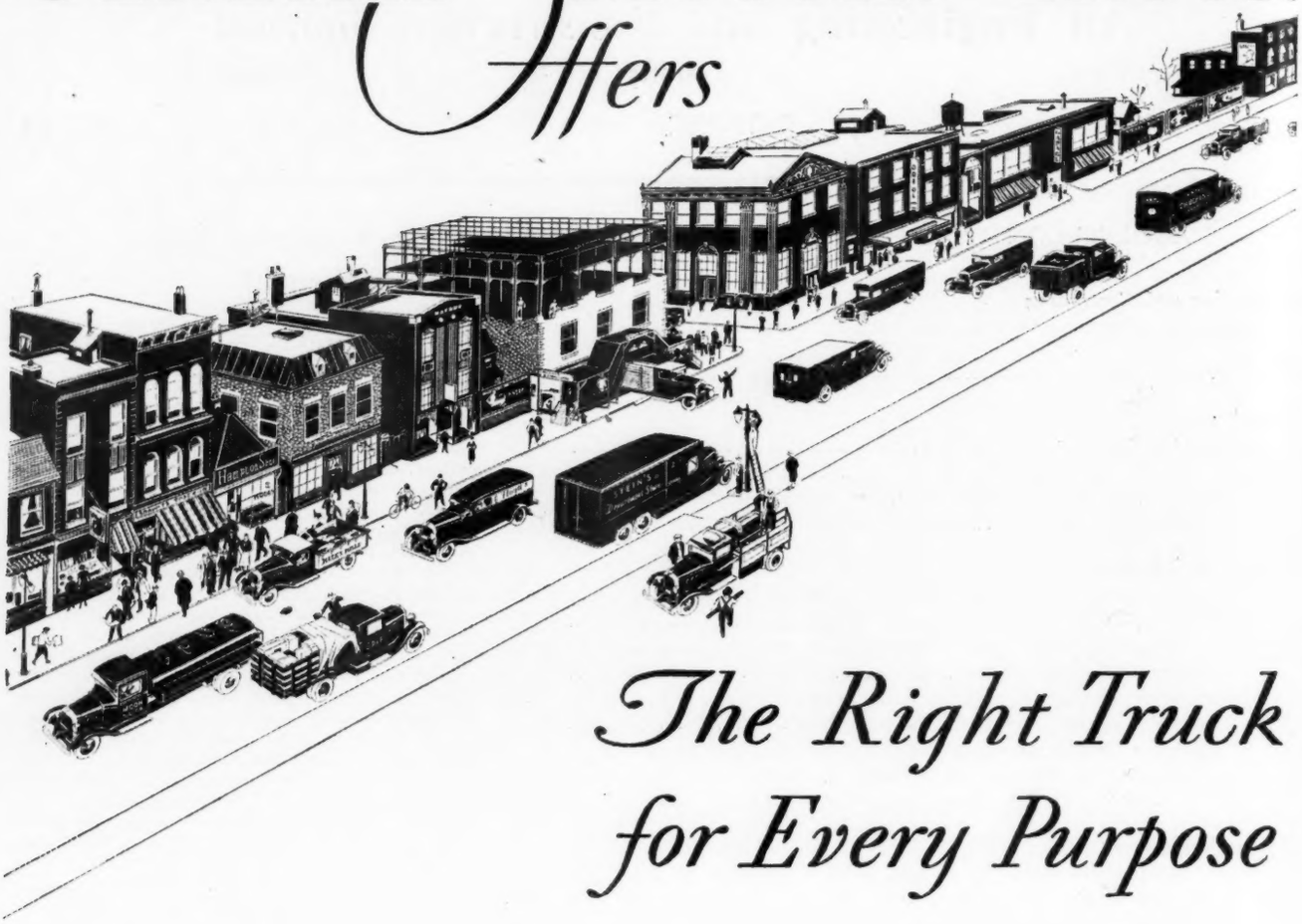


The Right Truck for Every Purpose

General Motors' name on a truck guarantees quality. The entire facilities of the General Motors experimental and research laboratories are at the command of the engineers who design General Motors Trucks. Each new truck model, each detail improvement, is thoroughly tested and *proved*, on the General Motors Proving Ground.

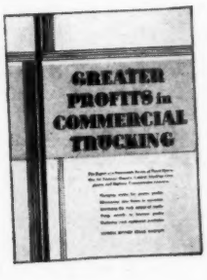
General Motors Trucks are outstanding values. The economies achieved—in purchasing—in manufacturing—in distributing—through the Company's affiliation with the General Motors Corporation, are passed along to the user in lowered prices.

General Motors Trucks are designed from radiator to rear axle by engineers who specialize in trucks. They are produced in a modern plant that builds commercial vehicles exclusively. They are sold by truck dealers, serviced by an exclusive truck-service organization.

One responsibility over every truck in your fleet

If you operate more than one type and size of trucks, you will find two-fold value in the completeness of the General Motors Truck line. You can buy all your trucks from the same dealer—and take maximum advantage of fleet prices and discounts. You can get service for every truck in your fleet, from the same service plant. And you can always count on unbiased counsel in the selection of the correct truck for each class of service. The purchase of any model may be financed, at the lowest rates available anywhere, through the Yellow Manufacturing Acceptance Corporation.

GENERAL MOTORS TRUCK CO., PONTIAC, MICHIGAN
(A subsidiary of Yellow Truck and Coach Manufacturing Company)



Selecting The Right Truck

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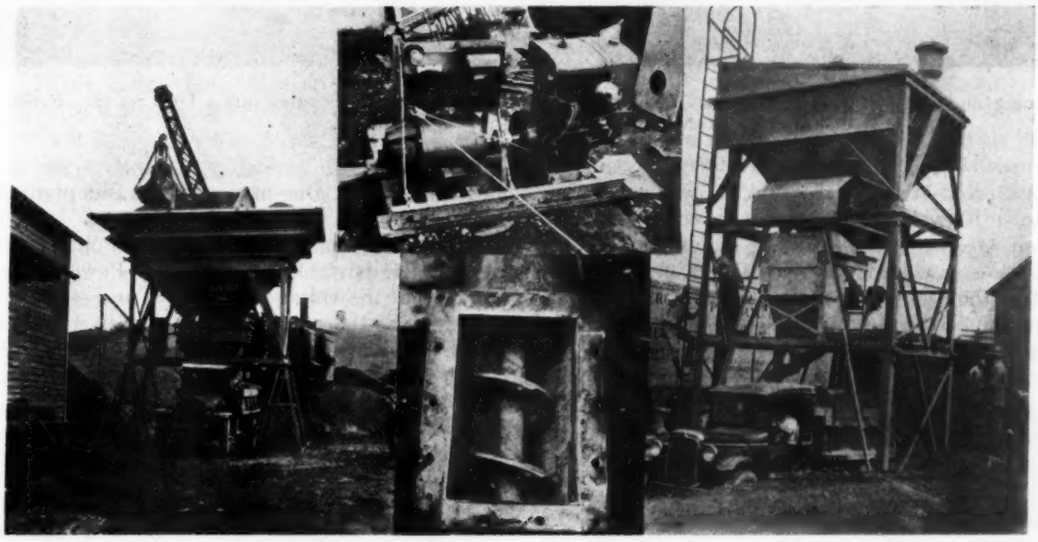


Left, the Blaw-Knox Sand and Stone bins; center, above the screw, a portable electric unit which furnishes power for handling the bulk cement. The screw conveyor is shown below at the center and the bulk cement bin with batching device is at the right.

How One Contractor Handles Bulk Cement On Highway Construction

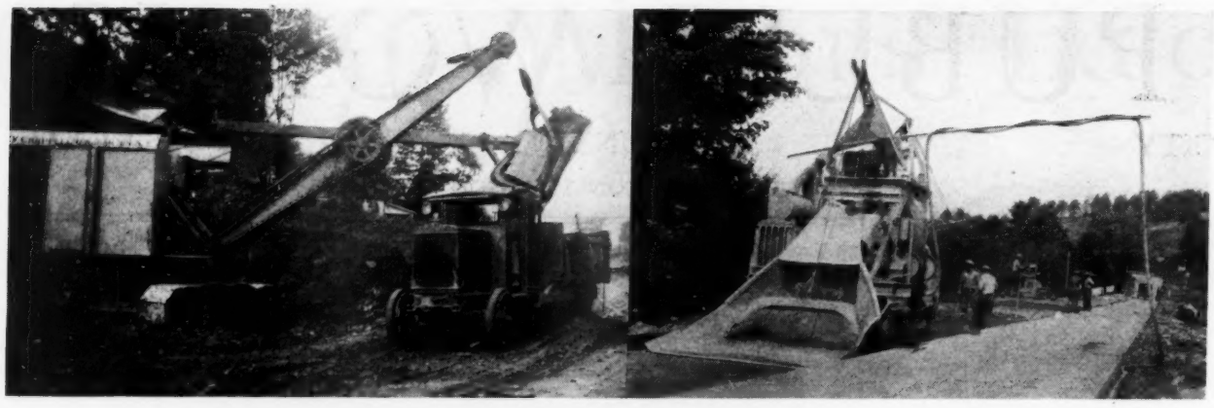
BULK cement is being used by E. V. Chappell, contractor of Binghamton, N. Y., in the construction of a section of Route 17, between Windsor and Deposit, N. Y., and in handling his bulk cement problem he is using a minimum of special equipment. Except for the loading and handling devices at the batching plant, standard equipment is used throughout, and in employing such standard equipment, most of the usual vexations connected with the use of bulk cement have been done away with.

Standard 2- and 3-batch bodies are used for hauling the aggregate to the mixer. The stone is first deposited in the batch compartments; the trucks then pass to the cement batching plant where the proper amount of bulk cement is added to each compartment. Following this, the trucks are returned to the fine aggregate bins and the required amount of sand is placed on top of the loose cement. While this plan necessitates two trips to the sand and stone bins, and some lost time, this is not serious, and in a place less restricted than is available at this particular location, a loading layout might easily be arranged that would make this practically negligible.

The question of placing the sand, more or less wet, on top of the cement has arisen, but the general opinion is that such a practice is not a seriously objectionable one, especially in view of the relatively short hauling time to the mixer.

This method of loading the materials was adopted after several unsatisfactory methods had been tried out. At first, the cement was placed on top of the sand—that is, on top of the load—but there was considerable loss from air currents or wind in hauling. Also placing the cement in the batch boxes first was tried, but, as has usually been found on other jobs, the bulk cement does not dump clean under such conditions.

Hercules portland cement is shipped in special bulk cars to Gulf Summit, N. Y., at which place the loading plant is set up. The cement is unloaded from the



The beginning and almost the end. Left, a Thew-Lorain Shovel on excavation is loading into a Linn tractor. Right, a Foote mixer pouring the final strip of pavement.

cars by a Sproul-Waldron screw conveyor, and elevated into a Blaw-Knox bin which is equipped with Richardson electric scales. These scales operate by means of two screw feeds, one carrying a much larger volume than the other. As the scale nears the balancing point, the larger feeder cuts off, while the other continues to feed a small amount of cement into the hopper. As the scale balances, this feed, too, is automatically cut off. One man operates this plant through a button control. It is dustless.

Current for operating the plant is obtained from a small LeRoi portable power plant. Power is available nearby, but the voltage is too low, and it is cheaper to manufacture the power than to put in a transformer.

Sand and stone are shipped in. Sand is unloaded from the cars into a Blaw-Knox batching bin by an Erie crane equipped with a clam-shell bucket. Stone is unloaded by means of a pit and a Good Roads bucket elevator to a stock pile, from which it is handled into the bin by the Erie crane.

About 7 trucks are ordinarily employed for hauling to the mixer, including Ward-LaFrance, Mack, Brockway, Dodge and International. Two of these trucks are 3-batch, and five are 2-batch. The mixer is a Multi-Foote 27E. A consistently good rate of progress has been maintained on paving on this job. A Lakewood screed is being used. The pavement is being laid in two strips, as is the usual practice on New York highways.

The contract involves 4.46 miles of 20-foot concrete pavement, all but about one mile of which is new location. This was practically necessitated by the location of the old road along a hillside, where good alinement and sufficient width would have been costly to secure. The relocation has required the changing of the channel of a creek for a considerable distance. The relocation is chiefly on low ground, and with more than usual rain this spring and summer, the fills have been soft. Most of the 150,000 cubic yards of excavation have been handled with a Thew-Lorain 75, assisted by an Erie, Type E, loading into Linn tractors. The fills are knocked down and leveled with a Caterpillar "30" equipped with a La Plant-Choate bulldozer.

Roger Bennet is assistant engineer in charge of the work for the state, and J. W. Holler is engineer of the Binghamton District, in which the work is being done.

A Very Wide Water Screen

This photograph, taken from a somewhat modernistic viewpoint, illustrates one of the two widest water screens in the world. These two water screens are installed at the Chain-of-Rocks Pumping Station, City of St. Louis, Missouri, and are Link-Belt Type "D" traveling water screens. Each is 125 inches wide and 56 feet 6 in. centers.

Lancaster Planning Sewage Treatment

The village of Lancaster, Erie county, N. Y., is now engaged in the preparation of drawings for modifications and alterations to the existing sewage treatment works. It is expected that the improvements will be made soon.

Widening and Salvaging an Old Concrete Road

IN widening and resurfacing 7.74 miles of the New York State Highway between Milford and Cooperstown, a number of interesting problems in both design and construction were solved. The old road was of 5-inch, uniform thickness, concrete, 16 feet wide, on which a thin bituminous top had been placed. Plans called for widening to 20 feet, and surfacing with a minimum of 2 inches of Type 4 cold mix resurfacing.

It was decided to add a section of concrete 2 feet wide and 8 inches thick on each side of the old pavement, the top of the new concrete to be flush with the old surface. The alinement of the old road was fairly good, but was improved by the judicious placing of the extra widths, and by occasional short stretches of new location. On tangents, the plan of a 2-foot shoulder was adhered to, but on curves the widening was so placed as to improve the alinement to the greatest possible extent, more being placed on one side than on the other, and in some cases all 4 feet on one side, where this would flatten the curve or otherwise improve the alinement.

The contract was awarded to the Binghamton Construction Co. at $262,218, which price included the construction of several new bridges.

The contractor broke up the old shoulders with a Rome grader equipped with a scarifier, and removed most of the material with an Erie shovel. Some hand work was needed, of course, but a remarkably large percentage of excavation was handled in this way.

After fine grading and setting of forms, the widening strips were poured. The concrete was brought from a central mixing plant in Ford trucks equipped with side dump, one-yard bodies, made by the Eagle Wagon Works, Auburn, N. Y. The maximum haul was 6 miles. The trucks would drive alongside the section to be concreted and dump the batch almost exactly into place.

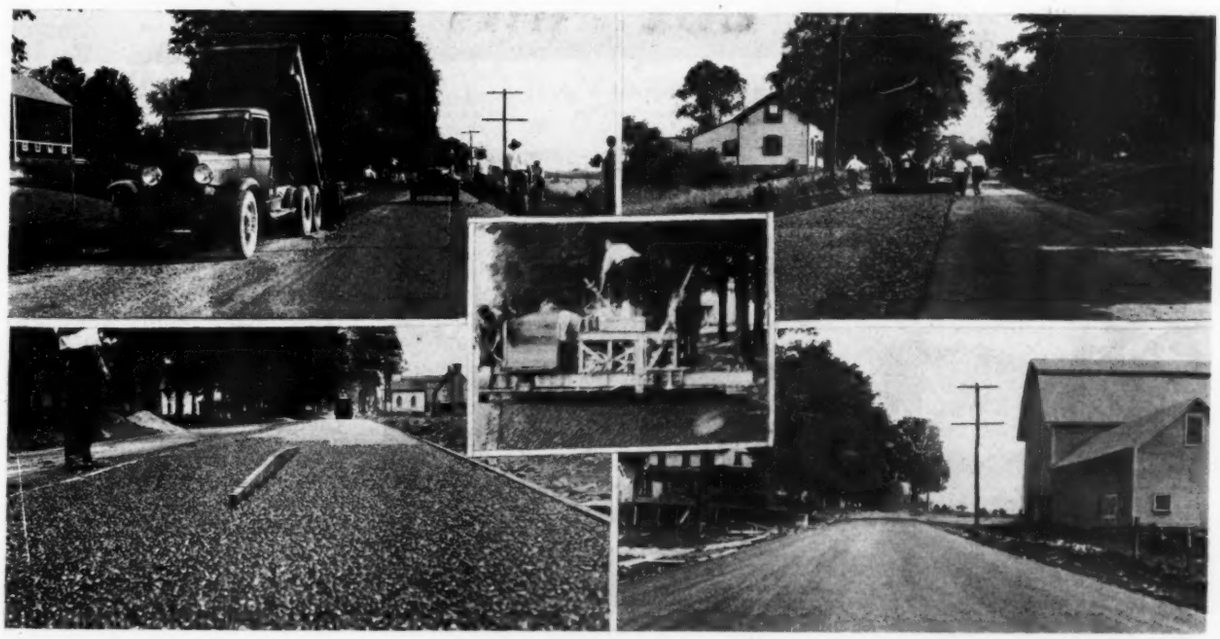
At the central mixing plant, a crane loaded the aggregate into Butler bins, from which materials were chuted into the mixer, a Rex 27E paver, which dumped the concrete directly into the trucks.

The surfacing is manufactured by the contractor at Jordanville, N. Y., at the Associated Gas & Electric Co. quarry in a 300-ton Cummer plant equipped with 40-ton dryer-cooler, 2-ton mixer with Timken roller bearings and 150-ton storage bin; all driven by direct connected motors and speed reducers.

The surfacing is hauled to the road in five 10-ton Stewart trucks, equipped with Wood hoists. A pair of Chevrolet trucks are also used part of the time on hauling surfacing.

After some experimental work on hand spreading, the contractor has mechanized his equipment, at the same time getting results in so far as riding qualities go. All surfacing is now spread mechanically and screeded mechanically. The trucks dump into a Burch spreader which gives very satisfactory results.

In order to use the mechanical equipment Hotchkiss forms are placed on the outer edge of the pavement,



Top, left, dumping and right finishing. Below, left, the screeded surface rolls out smoothly—note straightedge. Right, finished pavement. Center, the Lakewood screed at work.

The truck dumps into the spreader, which is closely followed by the screed. Note center and side forms.

projecting 2 inches above the surface. One-half the width of the road is being surfaced at a time. On the center line is placed a form composed of heavy plank topped with iron. This is of the necessary thickness and is placed in advance of the spreading of the bottom course.

The surfacing is spread in two layers—the bottom course of 1½ inches and as much more as may be required to fill holes and depressions and bring the surface to the required grade; and the top course of about ½ inch.

As the bottom course is spread, it is screeded and leveled with a Lakewood finisher with adjustable end shoe screed. The finisher or screed, moving on the stiff forms and the plank-supported iron (the plank takes up minor inequalities in the concrete more readily than metal) gives an exceedingly smooth and even surface. The smoothness of the bottom course is important, as it is never possible to remedy in the top course all the defects in the bottom course. After screeding, the course is rolled with an Acme 10-ton gas roller.

Following the bottom course, the top course, which is made up of 1 and 1a stone and dust, is placed. A piece of flat iron is used for the inside form, the surfacing is spread with the Burch spreader, screeded with another Lakewood machine, and

The bituminous material is dumped into a Burch spreader and then screeded with a Lakewood finisher.

Compare this scene, where hand spreading is used with the one just above.

rolled with a Springfield roller.

No interior or center forms are needed, of course, in completing the second half of either the bottom or the top course. A remarkably smooth center joint results which disappears almost entirely with final rolling.

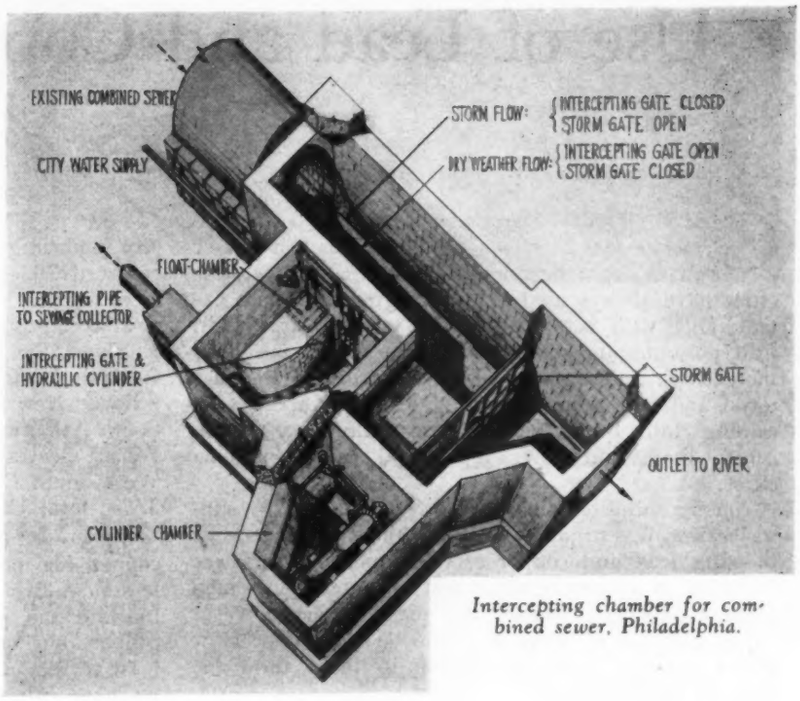
While the spreader and mechanical screed have been very successful on this job and has resulted in economical construction and an unusually smooth riding surface, there is some doubt if these methods could be applied, as yet, to cold mix material which has been shipped in cars, and therefore has had time to take an initial set up.

(*Continued on page 48*)

Intercepting Chamber for Combined Sewers

By August Sauer

Professional Engineer
Member of the Society of Municipal Engineers


EXISTING COMBINED SEWER
CITY WATER SUPPLY
FLOAT-CHAMBER
INTERCEPTING PIPE TO SEWAGE COLLECTOR
INTERCEPTING GATE & HYDRAULIC CYLINDER
CYLINDER CHAMBER
STORM FLOW: { INTERCEPTING GATE CLOSED / STORM GATE OPEN
DRY WEATHER FLOW: { INTERCEPTING GATE OPEN / STORM GATE CLOSED
STORM GATE
OUTLET TO RIVER

Intercepting chamber for combined sewer, Philadelphia.

DURING recent years sanitary engineers have recognized the inadequacy of the so-called "combined" sewer, designed as a carrier of storm water, industrial waste and house sewage, particularly when they are confronted with the problem of preventing pollution of streams and rivers.

Before the residential and industrial sections of Philadelphia had reached their present state of development, the disposal of sewage into the Delaware river had little effect on so large a body of water. But with the growth of the city, pollution of the river became not only apparent, but an alarming problem. The fact that part of the city's water supply is obtained from the Delaware river in the immediate vicinity of a large industrial area, added greatly to the apprehension which was felt among municipal engineers. State laws, prohibiting the dumping of raw sewage into streams and requiring the abolition or correction of this practice, gave the final impetus to an intensive study and subsequent program of reconstruction.

The requirements which had to be met, where "combined" sewers were in use, included:

1. Diversion of dry-weather flow into a treatment plant.
2. Direct flow of storm water into river.
3. Prevention of tide water in sanitary sewers.
4. Automatic functioning of gates.
5. Overflow provision in case of failure of gates to operate.

To change the existing "combined" sewerage system into a truly "separate" system would not only require much time, but would incur expense to property owners and the city far greater than could be expected to be borne by a municipality already staggering under its taxes. It was, therefore, decided to investigate the possibility of utilizing the existing sewers.

The area involved consists largely of flat, low land, giving a minimum cover over the top of the sewers; the sewers are subjected to the action of the tide, amounting to about 2½ feet at this location. The dry-weather flow is relatively small and velocities low, and flushing is accomplished by storm flow. Treatment of sewage would inevitably require a pumping station to raise the sewage above the high-water line of the tide.

With these factors established, it was decided to continue the use of the combined sewer as such to a point (near the river) beyond which little or no house and industrial sewage entered into it. At this point, a section of the sewer was to be removed and replaced by a chamber equipped to function in the following manner:

A large gate (sliding horizontally and indicated on the drawing as the "storm gate") effectively blocks the dry weather flow, which is diverted through a smaller gate (operating vertically and called on the drawing the "intercepting gate") into a sanitary sewer flowing in the opposite direction and carrying the sewage through a grit chamber to a pumping station and treatment plant. The horizontal gate, incidentally, prevents tide water from entering the small sanitary sewer.

To meet the requirements in case of storm flow, a float chamber is provided a few feet back of the gates. Rising of the water level in the sewer and float chamber results in the operation of a four-way valve, actuated by an extension arm from the float. This valve controls the flow in a pipe connecting the city water system to the hydraulic cylinders which operate the gates. This opens the large gate, allowing the storm flow to proceed directly to the river, carrying with it the small amount of sewage which would normally run to the treatment plant. (Being greatly diluted

(Continued on page 67)

Use of Lead and Copper Service Pipes

GALVANIZED iron or steel has long been used more generally for service pipes for water than any other material; but a great many cities have always used lead to a greater or less extent, and, with better knowledge of why and when lead poisoning may be possible, the use seems to be increasing; and copper, with lower cost of the material and better understanding of its advantages, is coming into quite general use; while cast iron, cement-lined and other pipes find favor in some cities.

Among subjects which we have been asked by subscribers to investigate was the methods employed for thawing lead and copper service pipe, and this was included in a questionnaire sent to water works men a short time ago. Among the questions asked were: "How many lead services have you in use?" "How many copper?" and the replies to these form the basis of the following.

When the analysis was made (replies are still dribbling in), 663 replies had been received. A number of them paid no attention to this question and undoubtedly a few of these—probably 5 to 10 percent of all reporting—have lead or copper services in use; but as there was no way of knowing this, no allowance was made for it and therefore the percentages of cities using such services, as reported herein, should probably be increased somewhat.

Use of Lead Pipe

Of 101 New England cities, 28 report using lead pipe, some for all services, others for less than 1%. This is equivalent to practically 28%. Of the Middle Atlantic States, 44% so report; of the South Atlantic, 22%; East South Central, 43%; East North Central, 65%; West North Central, 60%; West South Central, 60%; Mountain, 38%; Pacific, 18%. Of the total 663 cities, 310 reported using lead, or 46.8%. For the reason stated above, it seems probable that at least 50% of the cities use more or less lead services. Of these about 20% use lead exclusively, while about 20% more have used it for more than 90% of their services. About 60% of the 310 also report the use of copper services to some extent.

The fact that a city reports only 50% of its services are lead does not mean that it is laying new services of other material—it may have been laying nothing else for years, or since the first half of the services were laid. On the other hand, of course, it may be that the first half were of lead and some other material adopted for the later ones.

Use of Copper Pipe

Very little copper pipe was used for services prior to about ten years ago, so that it would not be expected that many cities would report all their services of copper. As a matter of fact, only two so reported, and only three others reported more than half their services of copper. However, one city reported laying all copper now; another, all copper since 1829; two others, all copper in the future; while another is also replacing old iron services with copper, having replaced 703 in 1930, or about 24% of all the services in use.

More cities report using copper than lead in New England, the South Atlantic States, the West North Central, Mountain, and Pacific. The figures are as follows: New England, 45%; Middle Atlantic, 28%; South Atlantic, 24%; East South Central, 27%; East North Central, 39%; West North Central, 43%; West South Central, 57%; Mountain 48%; Pacific, 37%; total United States, 38%.

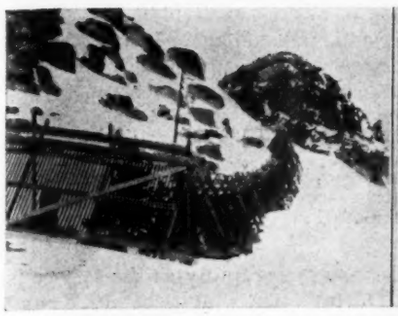
Since few if any of these cities have been using copper for more than ten years, and most of them less than five years, these percentages do not at all indicate the percentages of all services which are copper, but only that this number of cities are at least trying out copper. To give a better indication, we have calculated the relation between the number of copper services in use and the number of services of all kinds laid in 1930. If the number laid in 1930 was practically the same as that laid in each of the ten years previous, then a city reporting say four times as many copper services in use as the number of all kinds laid in 1930, presumably has been laying few other than copper for the past five years or so. Unfortunately, the majority of cities laid fewer services than usual in 1930, so that these figures can not be so interpreted. It is believed, however, that the services laid in 1930, averaging the entire country, approximated half the normal, and that the figures divided by two will give some idea of actual conditions.

Without making this correction, the factors found are as follows: In the New England States, the 45 cities report 7 times as many services as the total number laid in 1930; the Middle Atlantic States, 10 times; South Atlantic, 9½ times; East South Central, 2¾ times; East North Central, 5½ times; West North Central, 4 times; West South Central, 8½ times; Mountain, 5 times; Pacific 2½ times; the whole United States, 6 times.

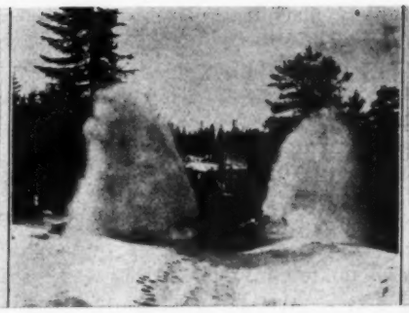
Assuming as explained above, that these figures should be divided by two, and that few copper services were laid prior to ten years ago, it would appear probable that 38% of the cities of the country are using copper pipe, and that they have averaged laying 30% of their new services in copper for the past ten years—most of them probably 60% for the last five years.

Olean and Depew, N. Y., to Treat Sewage

A complete engineering survey is being made of the city of Olean, Cattaraugus county, N. Y., preliminary to the preparation of plans for the interception and treatment of its sewage. Plans for similar facilities for the village of Depew, Erie county, have already been completed.



A typical snow fence.



Rotary plow on dual motored four-wheel-drive truck, making first cut through two feet of snow.

Showing result of fast thawing shortly after removal of snow near Donner Summit, 1931.

Handling Snow on California Mountain Roads

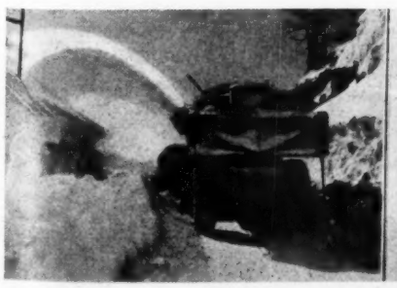
The Sierra Nevadas in northern California are crossed by several highways carrying traffic to and from the east, and under present conditions this tends —or wishes—to be all-the-year traffic. But the heavy snow falls in these mountains (averaging up to 65 feet a season in the worst places) render it exceedingly difficult—a few years ago it would have been called impossible—to keep these roads open. How this is accomplished in District Three, east of Sacramento, in the vicinity of Lake Tahoe, and some idea of the difficulties, are described by J. W. Vieckrey, district maintenance engineer of that district, in "California Highways and Public Works," the official publication of the California State Department of Public Works. Mr. Vieckrey's description, slightly condensed, is as follows:

Snow removal operations, to provide access to the recreational areas, where a depth sufficient to permit winter sports can be assured, has expanded tremendously in the last three years. The consequent costs have gone up at about the same angle that the snowflake comes down. The increasing flow of traffic over the roads opened is a good index to the demand, and the continuous enthusiasm of the thousands of snow sport devotees indicates that winter sports and snow frolics, at locations accessible to automobile traffic, have become a permanent part of California's list of recreations.

A Sunday traffic count made at the Auburn ski jump, when Route 37 was open only to Emigrant Gap, showed approximately 750 machines above the snow line. On February 15, the last day of the Truckee-Tahoe Dog Derby, there were approximately five hundred machines parked on the Truckee streets. Donner Summit was closed at the time. On February 22 there were about 1000 machines at Truckee and Tahoe City. The count going east over Donner Summit that day was between 450 and 500.

Snow removal work below the 5000-foot contour last winter was of very small consequence compared with a year ago. The snow equipment provided for such areas lay idle or was moved to higher elevations where the intensity of the storms, over a smaller area, made up any deficiency in the work to be done that may have seemed apparent when viewing the situation from the valley.

The first storm of the year began on Donner Summit on November 15, and during the night became a terrific blizzard driven by a 66-mile wind. Machines attempting to get over the summit before it closed crowded in so fast that the snow plows could not operate efficiently. Any idea of keeping the road open had to be abandoned and all effort made to get out the stranded machines and occupants. At times the storm was so severe that a man could not walk through the summit cut. The maintenance men spent all one night and most of the next day getting people out of the storm. When the skies cleared on the 19th, there



Rotary plow on four-wheel-drive truck, widening roadway through cut on Donner Summit, February, 1931.

Dual motored four-wheel-drive truck breaking through plug just west of Donner Summit.

Push plow on three-ton, four-wheel-drive truck, clearing roadway on Donner grade, February, 1931.

was five feet of snow piled up, and thirty machines were snowed in; some completely covered. The rotary plows were started again. The road was plowed out, the machines rescued, traffic was resumed, and steel gates installed on either side of the summit to prevent a recurrence.

The intensity and duration of the storms in this area have emphasized very emphatically the necessity of fast equipment for snow removal work. Experiences to date have indicated that successful and satisfactory snow removal is dependent on adequate equipment, both quality and quantity, and that it must be designed for the locality in which it is to work.

Early in our snow removal work we discarded all tractor types of power because of lack of speed, and installed all plows on pneumatic tired trucks.

Light trucks with low moldboard plows handle the snow very satisfactorily below an elevation of 3000 feeet. Above that elevation and up to 5500 feet heavier trucks with slightly higher plows are very effective, especially with a little assistance from a rotary to widen cuts. Above 5500 feet rotary plows and four-wheel drive trucks are employed practically all the time to widen trenches and dispose of windrows made by the push plows.

Each piece of equipment is kept very close to its assigned section during the entire snow season, and as soon as indications of an impending storm are apparent it is made ready for snow work. When the snow reaches a depth of four inches on the sections below 5500 feet the plows are started and operations carried on continuously for the duration of the storm. The gates are closed and locked and watchmen go on duty to prevent machines attempting the higher elevations. After the storm the road between the gates is cleared and traffic resumed. Barometers are kept at all maintenance stations in the snow area as an aid to determining weather conditions.

The work is very strenuous and none except the men who are accustomed to cold and severe weather can stand the strain. On the night shifts the conditions are very severe indeed, and it is not practical to attempt to operate equipment which does not provide an enclosed cab and the very best lights. The trucks at Truckee have come in off the night shifts with icicles twelve inches long hanging inside the cabs, and a solid mass of ice extending from the radiators to the plows. It has been estimated that the trucks have come off shift at times carrying from two to two and one-half tons of ice.

Steam-heated truck sheds are provided at the maintenance yards in the higher elevations, and an adequate supply of hot water is always available. The trucks are cleaned of ice and serviced at the end of each shift, and between storms they are thorougly checked over and necessary adjustment made to prevent breakdowns on the road.

The demand for open roads is rapidly extending the snow removal work to all routes leading into the Sierra Mountains that are surfaced to withstand winter traffic, and is rapidly becoming a major item of traffic service.

The costs are increasing as rapidly as the service is being extended. During the winter of 1928 and 1929 there was expended in the district less than $3,000 plowing snow; during the 1929-1930 season the cost reached $13,500 and during 1930-1931 it exceeded $18,000.

Welded Pipe Spans Road

By Jos. C. Coyle

When it became necessary, recently, for the highway department of Jefferson County, Colorado, to replace a 24 inch, 14 gauge, riveted pipe, carrying irrigation water across a cut 40 ft. wide on one of the county roads, it was decided that an all-welded pipe, including field joints, would give the installation more strength, considering the unusually long span. Also, to be sure that the unsupported span did not exceed 40 feet, care was taken to give eight feet of each end of the installation solid bearing.

The 56 ft. of 15 inch, 10-gauge, pipe required was made up in one 16 ft. and two 20 ft. lengths at the factory of the R. Hardesty Manufacturing Company, Denver, and the field joints welded with special equipment of the firm. All pressure pipe made by the company is welded and ranges from 6 in. of 16-gauge to 84 in. and larger of ¼ in. metal. Standard practice is to swedge one end of each section to admit the end of the next section at least an inch without decreasing the inside diameter of the pipe. The installation was placed together and welded on the ground, then slid into place across the cut, after two coats of asphalt preservative had been applied.

A specially equipped Chevrolet truck, carrying a G. E. motor generator, furnished current for welding field joints. The rear axle was jacked up and placed on wooden horses and a belt connected from the generator to a pulley attached to the left hub. George Davis was road superintendent in charge of the work and George L. Duvall, county commissioner, arranged for the installation.

The power unit

Welding a field joint

The welded pipe in place

Top row—Spreading and grading the sand cushion, and laying brick and rolling it to a smooth surface.

Bottom row—Pouring and squeegeeing the filler. Meet sub-contractor Leonard Rose looking over the job.

Low Cost Brick Resurfacing in Newburgh

VITRIFIED brick are being used for resurfacing Broadway, Newburgh, N. Y.—a heavy traffic street which was paved fourteen years ago, but under the continuously heavy and fast traffic which it had to sustain, the surface became so worn and rutted that the city decided to resurface it with vitrified brick, utilizing the old base, which was in good condition.

The old surface was first removed with a Keystone skimmer shovel and hauled away and the base cleaned. Street car tracks, which were no longer being used, were removed and concrete was placed to make this section uniform in strength and surface with the remainder of the base. This was the only preparatory work necessary.

The new brick pavement is of 2½-inch Metropolitan block laid on a 1-inch sand cushion and filled with asphalt. The procedure in construction is not different from general practice. The sand for the cushion is dumped in piles on the base, while the brick are piled along the curbs. The sand is spread by men with shovels in accordance with grades given by the inspector at every 50-foot interval. For surfacing the sand, boards are placed on the concrete base, and on top of the boards are placed flat steel strips of convenient length. These boards and strips are run from curb to curb at 8 to 10-foot intervals and are used as guides for templates which strike off the sand base to a uniform grade and section. After the sand has been struck off by the template men, it is rolled with a light one-man roller, and then smoothed and dressed up by one finisher.

Three bricklayers are used, each with as many helpers as are needed to carry brick to him from the curb. The number of helpers varies with the distance from the curb and the speed of the individual bricklayer and of his carriers. No machinery or special equipment was used at any stage in handling the bricks, which were hauled in ordinary truck bodies from the cars to the street.

After the brick has been laid it is rolled with a light roller, filled with asphalt, and covered lightly with sand. Asphalt filler is heated in 3 wood-burning Universal heating kettles and brought to the street at a temperature of 300 to 350 degrees, in ordinary concrete buggies or carts. It is dumped on the surface as needed and squeegeed into the joints with rubber-faced squeegees. This is the primary filling coat. The final filling coat is applied by one man, using the same sort of squeegee, but applying the filler as and where needed with a bucket equipped with a spout for pouring. An average of 11 pounds of filler per square yard is required.

The cost of the pavement, exclusive of the construction of the new base in the area from which the street car tracks were removed, amounted to $2.05 per square yard. W. J. Blake is city engineer. Curtis and Harper, Inc., of Newburgh, is the general contractor, and Leonard Rose of Buffalo is subcontractor on the brick construction.

Woonsocket's Activated Sludge Plant

Aeration tank, showing agitation secured by air.

AN activated sludge plant containing several novel features has recently been placed in operation by the city of Woonsocket, R. I., to handle the sewage of a population of about 60,000. The present population is about 50,000, of which about 15,000 are employed in 87 industries, most of which are served by about 55 miles of sewer ranging in size from 8″ to 36″. Much of the industrial waste, carrying considerable grease, had been discharged directly into the Blackstone river (which runs through the entire city), as had also about one and a half million gallons of domestic sewage—the excess over the capacity of the treatment plant formerly in use.

The river, thus highly polluted, gave off very offensive odors. During the summer the dissolved oxygen above the city averaged 70 per cent saturation, but this fell greatly as the river flowed through the city, zero having been recorded a short distance below the city. Finally the State ordered the city to construct a treatment plant to handle all the sewage and industrial waste, destroying practically all bacteria and producing such an effluent that the dissolved oxygen in the river should never fall below 50 per cent saturation.

The treatment works formerly used were designed by the late Rudolph Hering and consisted of two receiving basins with a capacity of 500,000 gallons, a pumping plant and ten acres of slow sand filters. For the new plant Remington, Vosbury & Goff, of Camden, N. J., were chosen as consulting engineers.

Activated sludge treatment, with chlorination, was decided upon mainly for two reasons—because, the plant being located in the geographical center of the city, it was necessary to avoid all objectionable odors; and, second, with the activated sludge method a large part of the sewage, from the higher portion of the city, could enter the plant by gravity.

As part of the new works the existing pumping station was remodeled into an administrative building, housing the air compressors, the testing laboratory, the superintendent's office and one heating unit. Here also a dry well was built, in which were placed three electrically-driven, motor-operated, vertical pumps provided with non-clogging impellers. Two of these units are automatic, while the third is hand operated. These pump the incoming raw sewage from the lower level of the city and are of the variable-speed type, automatically controlled to work at speeds according to the rate of the incoming flow, varying from a minimum of 400 to a maximum of 4200 gallons per minute. A venturi meter records the volume of raw sewage pumped, and a depth gauge records various levels of the pump suction-well.

The air compressors, located in this administrative building, are in duplicate, and are of the high-speed, single-stage type developing a pressure of three pounds at 60 degrees Fahrenheit. The capacity of each compressor at this pressure is 4200 cubic feet per minute, and each is operated by an 85 horsepower motor. Of the air thus compressed, between 200 and 300 cubic feet a minute is used in the aeration skimming tank while the remainder is used in the aeration tank. In order to remove any solid particles, all air is filtered before being drawn into the compressor. Upon being discharged, air is passed through a venturi meter which indicates, registers and totals output.

With a capacity of 4400 cubic feet a minute, the motors of the compressors use 76 kilowatt input; with a capacity of 3600 c.f.m., 63 kw; 2800 c.f.m., 50 kw; and with 2,000 c.f.m. capacity, 37 kw are consumed. Engineers figure this consumption at about 15 kw per million gallons of sewage. At local power rates of about 1.45 per kw hour, the cost per million gallons of sewage will be about $5.65.

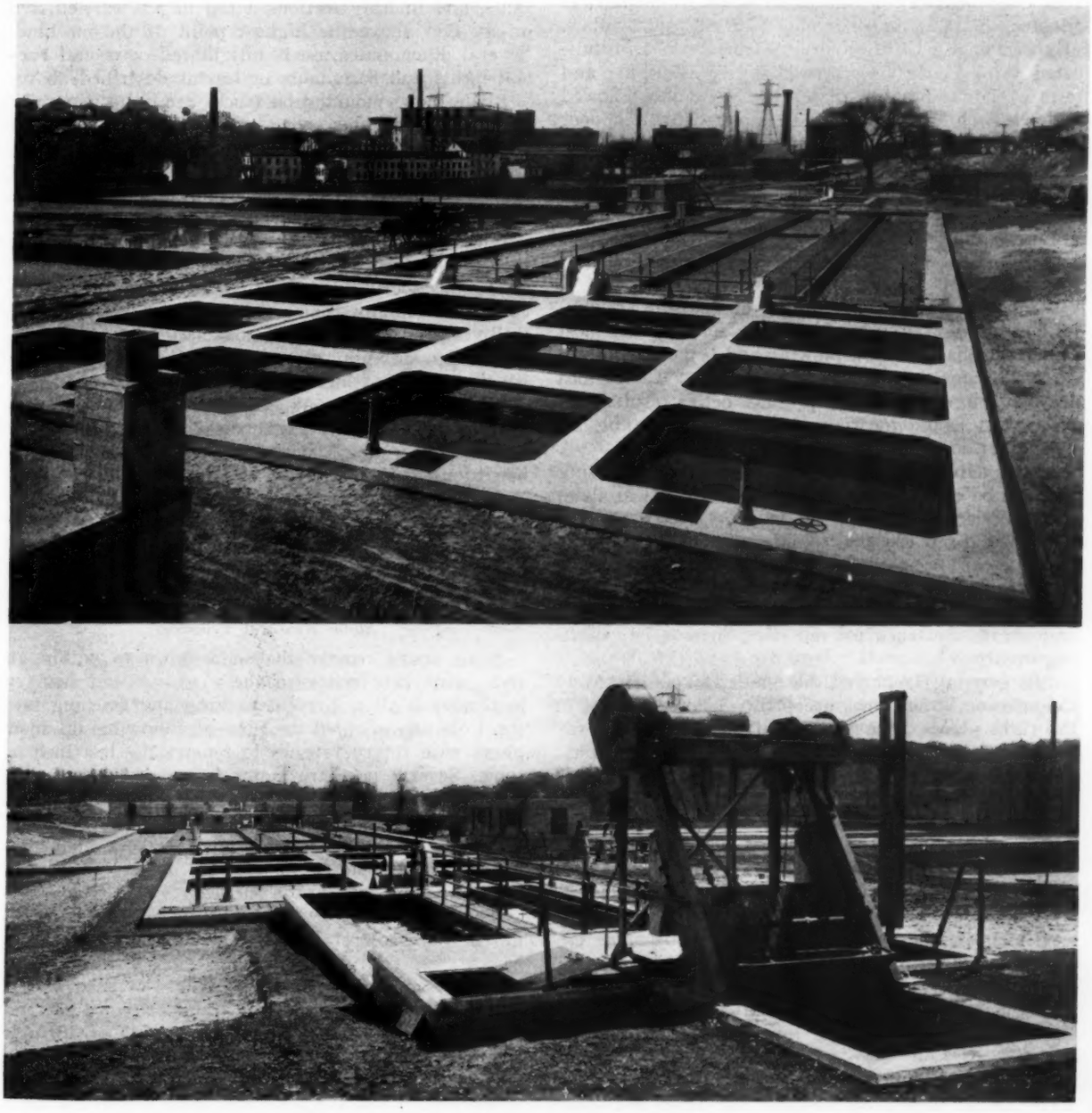
The raw sewage that enters through a 36-inch low-level sewer is pumped into the sewer carrying the sewage coming from a high section of the city, and the combined flow then enters the plant by gravity.

The sewage first flows through a mechanically-cleaned Link-Belt bar screen. Then, to remove most of the animal, vegetable and mineral oils found to considerable extent in the sewage of this city, an aerated skimming tank with a central chamber to house suspended air diffusers was constructed. These diffusers agitate the sewage continually, causing it to flow over baffles into collecting and returning chambers on each side. These latter were constructed with sloping bottoms, connecting to the central air chamber. Agitating the sewage with air causes the oils and greases to change to a soapy mixture which floats to opposite sides of the chambers, from where it is skimmed into troughs. At normal flow, sewage is detained in the skimming tank for about six minutes.

The skimmed sewage then enters the primary settling tanks, of which there are six planned to give at normal flow a detention of one hour. To distribute the sewage throughout the tank, tapered inlets are provided under the sewage level, emptying against a slotted baffle wall. The tanks are divided into two separate compartments, each equipped with mechanically-operated scrapers which are run once daily to remove settled sludge into storage hoppers, from which it is removed through a sludge pipe operated under a 4-foot hydrostatic head. These hoppers are flushed out daily by means of perforated piping inside them. Accumulated scum on the surface of the tank is removed by the returning scrapers, and gathered together at a scum trough located at the outgoing end of the tank where any floating materials are easily skimmed off.

The effluent from this tank discharges into a flume

(Continued on page 54)



General view of plant from intake end. Screen in foreground. Digestion tanks in background. Above: General view of plant, taken from top of digestion tank. Final settling tanks in foreground.

Snow Notes From State Departments

IN REPLYING to a questionnaire sent by the American Road Builders Association to the State Highway Departments, many of the latter described more or less at length some of their practices and ideas which will, we think, offer suggestions to all who have charge of keeping highways free of snow. The more interesting of these are given below.

Snow Removal Equipment

Colorado prefers balloon type pneumatic tires on four-wheel-drive trucks for carrying snow removal plows.

A considerable number of states have adopted special painting for snow equipment in an effort to prevent collisions of traffic with it. Most of them have adopted orange, orange-yellow, or bright yellow. (Experiments with fire hydrants some years ago indicated yellow as giving best visibility at night; and tests of house number plates by Milwaukee showed yellowish white on black to be most distinct in poor light.) However, gray is used by Connecticut, Michigan and Pennsylvania, and bright red by Idaho.

Michigan reports that "Bank cutters or independent wing plows are increasing in popularity. These units are used to push back banks and also for pulling banks into the plowed portion of the roadway where it is disposed of by using a V-plow."

Minnesota finds that disposing of roadside accumulations through proper winging is actually the most important phase of snow plowing and is the controlling factor in any snow removal program. "Indications are that longer wings will produce better results, and the design should incorporate features of suitable independent control of both ends of the wing. . . . A truck traveling 25 miles per hour should have a wing that can be raised 5 or 6 feet at its outer end in about two seconds."

Missouri reports that mold boards of worn-out graders can be used very satisfactorily in making small, straight blade plows for attaching to Ford and Chevrolet 1-ton trucks and drags which are slung underneath the truck for removing snow before drifting occurs.

"In general," reported the South Dakota Highway Commission, "the plows are plenty heavy, but not in the right places. The plow mold boards are in many cases unnecessarily heavy and the bracing and push beams too light. The hoisting or raising and lowering devices should be improved. . . . The bottom cutting edges should be made of thick, high-grade steel."

Several refer to the desirability of having the mold boards of plows unpainted and polished, but protected from rust. (This would seem to be a good place to use rustless steel.)

Illinois has had several units stalled by short circuiting of the ignition of the motors and freezing up of the intake manifolds by snow being sucked in through the carburetor. It should not be possible for snow to come through the radiator and melt on the motor.

In Illinois, gangs with only a straight-blade plow have found themselves caught, far from headquarters, blocked from behind with drifts too deep for them to get back through, even though the blade was carried by a heavy truck; and they are not supposed to go far in a storm unless they have a V-plow with them.

Massachusetts equips the tip of the left wing of each plow with a headlight-reflecting bullseye front and rear, and the left outer edge of the plow carries a diffusing spot light; also electric tail, head and spotlights are used, and a headlight-reflecting device at the rear of the truck. Minnesota carries a white flood light on the right end of the snow plow and wing, and a yellow flood light on the left end, and carries blue lamps near top of cab, front and back. Missouri equipment carries red metal danger flags at points of greatest danger; and Nebraska does the same, and in hilly sections a red flag is carried five or six feet above the highest point of the machine. Several other states use headlight reflectors and special lights and flags more or less as described above.

Blade plows mounted on trucks are quite generally used for the lighter snows—up to 6 to 12 inches of wet snow and 12 to 24 inches of dry snow. These travel from 15 to 35 miles an hour—20 is reported by most states—and it is the general opinion that the faster the better, both because more road is cleaned per hour and because the snow is thrown further to the side of the road. There are exceptions, however. In Connecticut "slow speed is recommended on account of complaint from snow being thrown onto sidewalks and drives." In Illinois accidents have been caused by speeding plows throwing packed snow or ice through windshields of passing cars.

Minnesota keeps the speed down to 10 or 15 miles an hour because "any faster speed tends to throw the snow, spoiling the vision and making the operation hazardous."

In Massachusetts the number of vehicles on the main highways, even during storms, makes it unsafe for snow removal equipment to travel faster than 12 miles an hour, but 20 or 22 miles is used on roads where traffic is infrequent.

Snow Removal Practices

Some states remove the snow down to within an inch, some two inches, of the road, while a few try to remove it all to prevent packing and freezing into ice. Colorado adopted the plan of following up snow plows with rotary brushes to remove the last inch of snow. Several northern states leave a few inches of snow for sleighing, especially on roads of light traffic. Minnesota leaves snow on roadway and shoulders, especially in wooded areas. South Dakota finds that gravel roads readily absorb the moisture from 2 inches of snow left on the surface.

The ice formed by the packing and freezing of unremoved snow or that which has melted creates a hazard, especially on hills and curves. Most states sprinkle sand, fine gravel or cinders at such places. Much of this is thrown off by traffic or blown off, and to prevent this quite a number of states sprinkle calcium chloride, either just before sanding or mixed with the sand, thus softening the ice so that the sand settles into it and freezes there. Some use coarse sand, but Oregon finds that fine sand stays in place better

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Highway Engineering Notes

Summaries of Reports by Committees of the American Road Builders Association on Important Phases of Highway Engineering

A Road Showing Poor Alignment

Obtaining Right of Way

RIGHT of way is a most difficult and annoying subject for nearly all highway engineers. The methods of acquiring right of way are varied. Counties or municipalities often acquire it at little expense. In a purchase by the state, payment may be based on assessed valuation, or be acquired by agreement or condemnation suit. While there are variations of these methods, they cover the methods in general use.

As a means of obtaining necessary right of way the following suggestions are made:

1. Right of way should be acquired by the state highway departments. The county in which the rights of way lie should pay into the state road fund the amount of the purchase price, or certain taxes now accruing to the county may be diverted to the state road fund to cover this.
2. The value placed on each piece of property should bear some direct relation to the assessed value.
3. The state highway departments should include as a bid item the removal of fences and obstructions from the limits of the right of way, the rebuilding of the fences from salvaged material and the construction of a standard type of right of way fence where necessary. If the property owner desires a better fence than that constructed by the highway department, he may construct it at his expense.
4. The highway department should provide suitable passage onto the new road for the property owners, at least as good as that existing before the improvement.
5. That the highway department will so handle the construction as to cause no damage to the property owner and will construct such retaining walls, etc., as may be necessary for protection of his property.

Distributing Construction Costs

Road construction costs should be figured over a period of time influenced by the location of the highway and the width of the right of way. If the road is properly located and the right of way of sufficient width to permit expansion, the costs can well be figured over any period of years necessary for the retirement of bonds; sometimes as many as 40 years. Any recommendation as to distribution of construction costs must be considered theoretical, but the more nearly an equitable distribution of these costs is approached the more justly the tax burden is carried. If good location and width of right of way are not obtained, the theory is entirely wasted. While the construction cost might be spread over a number of years, the road may be abandoned before being paid for. Suggestions of cost distribution, therefore, are founded on the theory that good location and sufficient right of way are furnished.

1. Costs of right of way should properly be borne by the community from ad valorem taxes. This is really the only permanent investment and is properly chargeable to property revenues.
2. The construction of grade line and proper structures is semi-permanent, but very likely will outlast the bonds when funds from bond issues retired by ad valorem taxes are used. It would seem proper and equitable that with the proper grade line, sight distance and curvature that no less than 50 per cent of the cost of grading and structures should be distributed over a period represented by the life of the bond issue for such construction, or in case of a state bond issue over a maximum period represented by the bonds, the other half to be paid by current income from year to year.
3. Distribution of costs of a rigid type of pavement such as brick, concrete or concrete base with asphalt surfacing should be spread over a period of not less than 20 years, and without departing from good business methods this may be paid for entirely out of a state bond issue or county bond issue retired by the taxpayers with an ad valorem tax, a gasoline tax or by some other method. If the surfacing is of some inexpensive flexible type, such as local gravel, with stage construction in mind, this work should be paid for with current income or with short term notes or bonds.

The statement that we should not burden the future generation with debts to pay for improvements being made now can be only partially substantiated, for some of our improvements are permanent, or semi-permanent, and the next generation should assist in paying for them. Although done, it is not so equitable to charge the next generation with expenditures on highways which have been worn out or abandoned.

In general, it is recommended that (1) as far as practicable a distribution of cost be made on the basis of permanence or semi-permanence conditioned on proper location and sufficient right of way for future use; (2) on surfacing, a distribution should be made over a sufficient time, depending on the quality of improvement, which apportions to the taxpayers a uniform annual share of such cost. The lower the type of road the more the costs should be charged to the present and near future.

Trends in Highway Bridge Construction

Traffic may reasonably be expected to increase during the next several decades, and it seems advisable to design substantial structures which can be altered for future traffic requirements with minimum expense. An attempt is being made to provide in some measure for future demands as indicated by the following trends of practice:

1. Existing bridges are being widened.
2. New bridges are being made from 4 to 10 ft. wider than in 1928.
3. Steel I-beams are being used to a greater extent in several ways:
   (a) In the place of pony truss spans in lengths up to 90 feet.
   (b) Instead of reinforced concrete spans.
   (c) Instead of creosoted timber for stringers and caps on creosoted timber pile bents.
   (d) In the place of plate girders, both deck and through.
4. Concrete floors are being used for all kinds of bridges.
5. Roadways are being made 24 ft. wide for 2 lanes of traffic.
6. Raised or high curbs and very much stronger railings are now being made.
7. Improved alignment is sought consistent with speeds of 45 to 60 mi. per hr.
8. Roadways are being kept clear of obstructions to a greater degree than ever before. The underpass with pier in the roadway is condemned as dangerous.
9. The alignment, grade, sight distance, width of roadway, low crown on tangents and proper superelevation for curves are being made for safety at speeds of 45 to 60 mi. per hr.
10. The live loads used for designing bridges have been increased from 15-ton trucks to 20-ton trucks by several states to care for heavy single units and combinations of several heavy units in trains from 60 to 80 ft. long. Some of this traffic will reach secondary roads.
11. The clear height of roadway opening for truss spans has been increased from 14 to 15 ft. and even 16 ft. The portal brackets and similar encroachments are being removed from present bridges and avoided in new structures.

Where it is probable that a structure of any kind may be abandoned within 10 or 15 years it is well to build it of low cost materials which easily will last that long rather than invest in an expensive type which will be abandoned before it is worn out.

Timber substructures of treated piling are low in first cost, of long life, and if abandoned the loss in funds invested is small. Steel construction or creosoted timber construction can most easily be altered and with maximum amount of salvage. Floors on steel joists or creosoted timber joists can be of either wood or concrete.

Designing Low-Cost Bridges

Low cost roads should be low in cost throughout, including bridges and culverts, which offer a fertile field for real savings in first cost and in net cost over a period of years. Even though the expected volume of traffic becomes as great as on trunk highway systems, initial construction costs can be kept low by using a progressive type of bridge construction. The term "cost" as applied to highways and bridges is relative. A tentative definition of a low cost bridge, in terms of first cost, is one with a 20-ft. roadway which costs less than $100 per lineal foot for long spans and less than $50 per lineal foot for short spans.

Small Culverts.—Pipe culverts are made of corrugrated, galvanized iron or steel, concrete, cast iron and vitrified clay.

Pipe culverts of large diameter (4 to 7 ft.) instead of box culverts of equal area are becoming more popular as low cost structures.

Box culverts are commonly built of concrete, but treated timber, where cheap, has been used economically.

The minimum diameter of pipe in general use is 12 in., but 15 or 18 in. are preferable, and the maximum size varies from 5 ft. to 6 ft.

Headwalls may cost more than the additional pipe required to extend a culvert, so that headwalls may be omitted sometimes at the discharge ends of corrugated metal pipe.

Low cost bridges should be located with the same care as more expensive ones. If the best site for the bridge and road is not selected at the time of first construction, there will be considerable expense incurred in a later change to a better route.

In designing new bridges for safety the following general rules are given as guides:

1. Locate the bridge so as to obtain suitable alignment and grade for safe speed limit of 35 to 45 mi. per hr.
2. Separate an abrupt change in alignment from a vertical curve which is connected to steep grade.
3. At grade separations of railroad and highway the maximum grade of a highway should be 5 per cent, although 4 per cent is preferable, especially in regions having many days of freezing temperatures and icy pavements.
4. A sight distance of at least 500 ft. is recommended, and the layout of bridge and approaches should be made accordingly.
5. At an underpass there should be no piers or columns in the highway.
6. Guard rails should be built along the shoulders on embankment approaches.
7. Slipperiness of pavement should be avoided on new bridges and overcome on existing bridges.

Small hand torch

One-man operation of portable torch

The Filter Moth Fly and the Flame

A New Method of Psychoda Destruction

By Morris M. Cohn

Sanitary Engineer, Dep't of Public Works, City of Schenectady, N. Y.

CAESAR had his Brutus, King Charles his Cromwell—and the trickling filter its Psychoda alternata.

Too much has already been written about the small grey moth fly and its habits. It is a little-read plant operator who does not know how the fly eggs are laid on the media film by early residents. While it may yet be uncertain whether the fly or the egg came first, the observant operator is positive about what stages of fly life to expect before the troublesome adult deserts its pupal shell and spreads its wings. The black-tipped larvae, the brown grubby pupae and the red-faced adults are well-known to the plant that uses trickling filters for secondary treatment. Larvae counts are becoming almost as standard as agar counts. Attendants are digging into filter media and turning over gelatinous film with investigatory index fingers in search of the secrets of the fly's metamorphosis.

There may be those who do not have serious objection to filter flies. Counted among the numbers of these uncomplaining souls are not the neighbors of trickling filters, the plant maintenance men and those plant visitors who park their autos to the lee of filters on a sultry summer evening. The unsuspecting fellow who laid his blue coat on a filter gallery wall and returned to find the garment transformed to a living grey, the proud householder who painted his house near the sewage-works just when the flies went into intensive family rearing—these gentlemen do not doubt that Psychoda can become a nuisance.

Fly Control Measures

The battle against the filter fly has gone on in laboratory and plant. Attempts have been made to destroy the adult flies and all the intermediate stages of the pest. It has been a losing battle from the start. A perverse nature has made it impossible to root out the fly. The best that has yet been reported is a semblance of control. The operator who can report that his methods have kept Psychoda numbers below the nuisance point at a large filter plant must be classed among the most successful campaigners.

For practical purposes it is expedient to classify fly destruction methods as *primary control* and *auxiliary control*. Primary control includes those methods used to destroy large numbers of flies *within* the filter media at such regular intervals as to destroy a specific form of fly stage as it re-occurs in the cycle of fly metamorphosis. Among such methods are the well-known practice of flooding or submerging the filters and the less-recognized attempts to control fly breeding by means of heavy chlorination of the filters.

Secondary or auxiliary control methods are those used to destroy adult Psychoda, elsewhere than in the filters themselves, in conjunction with primary control. It is true that such methods of off-filter fly destruction are often the only ones used at some plants. Spraying is a typical auxiliary control method.

A New Method of Auxiliary Control

So much for retrospect. . . .

The Schenectady installation has witnessed some work on every practical method of fly destruction advocated by others or expounded by the writer. Periodic flooding has been used as routine during the past few years. A consistent program of spraying has been tried in an attempt to destroy such flies as leave the filters during flooding and to wipe out a percentage of the flies that develop to adult stage during the flooding intervals.

During the past summer season, a novel method of auxiliary control has been used to replace the usual spraying program. It is the old story of "the moth

Two-man operation of portable torch.

and the flame," adapted to sewage treatment. The method consists of singeing the Psychoda with a large portable, oil-burning torch, suitably arranged for the special task. The method is apparently new, as far as a review of current writings on the subject of filter fly destruction discloses. The process is sufficiently significant for all plant operators, to be worthy of description. It may do everything that the usual spraying methods can accomplish, at a more rapid rate and a lower cost.

Description of the Equipment: The apparatus used for fly singeing consists of a 10-gallon oil pressure tank, fifteen feet of special oil-resistant pressure hose and a special oil-burning torch. A second-grade kerosene or light furnace oil is placed in the fuel tank and the pressure built-up with a hand pump having a piston of two square inches area. The pressure tank is supplied with a pressure gauge, an air relief valve and a filling cap, together with the take-off union and valve leading to the torch. The fuel is forced as a liquid through the hose to the torch, where it passes through a pre-heating coil at a temperature of from 700 to 800 degrees Fahrenheit and is gasified and emitted from the nozzle, where it ignites as an intensely hot, almost invisible flame, which shoots out from the end of the torch. The flame developed is approximately four inches in diameter at the torch and about eighteen inches long. Pyrometer readings have recorded flame temperatures of 2000 degrees F.

Use of Torch: At the Schenectady works, the greatest number of flies that desert the filters themselves congregate on the vertical walls of the concrete filter galleries. The top of the galleries which serve as walks are not sought by the Psychoda. During a fresh breeze or a driving rain, the flies leave the windward walls and take refuge on the sheltered areas.

The three galleries, which act as pipe conduits and effluent channels, are each 313 feet long, 11.5 feet wide, and the side walls are approximately 3.7 feet high. Each side wall has an area of 1150 square feet and each gallery has a total of 2400 square feet of vertical roosting area, including the end areas; giving a total of approximately 7200 square feet of vertical area.

It is for the purpose of clearing these gallery surfaces of flies that the torch-flame has been used. Two methods of operation have been tried. In both cases, the pressure tank is strapped onto a regular two-wheel truck. When two men are used for fly control, one man trundles the cart along the top of the galleries and maintains the desired pressure in the outfit. The second man, dressed in high boots, walks on the filters along the galleries and applies the torch-flame to the walls with a sweeping, singeing action.

When one man is delegated to the flaming, a special arm is attached to the two-wheel truck in place of one of the regular cross-bars. The arm is composed of hollow tubing and extends out from the truck a distance of two feet. Into the end of the arm is placed a slip connection that affords horizontal and angular adjustment. The arm of the torch is clamped to this arm and the assembly adjusted so that the torch-flame spatters down the gallery walls as the truck is moved along the top of the gallery.

Both methods of flaming are equally effective. The walls are cleared of heavy infestations of Psychoda almost miraculously. The flies fall like so much chaff onto the stone along the gallery walls as the torch passes by. Few flies escape the shooting flame and the intense heat. The action on the flies varies, depending on whether they are directly hit by the flame or merely destroyed by the heat. Many have their wings singed, others are singed in the body and still others show scorched legs. The shape and color of the majority of the flies are changed but little. When the singeing has been carried out too rapidly, there is a tendency for a portion of the Psychoda to fall to the beds and spin about in a semi-stunned condition. A rapid sweep of the flame over the filter stones ends the struggle. The odor about the filters during the flaming process is similar to that observed when hair, wool or feathers are singed.

Cost of Flaming: Extensive timings and measurements of the quantity of material used in flaming the Schenectady filter galleries, indicate that each wall of 313 feet length can be covered in five minutes by either the one-man or two-men method. Each gallery has been covered in ten minutes and the entire three galleries have been singed in 45 minutes, this time including the intervals required for shifting the equipment from gallery to gallery, maintaining pressure in the fuel tank and short rest periods for the operators. The speed of flaming is markedly greater than possible with the old spraying methods. There has been no complaint from eye-smarting that usually followed the use of spray on a breezy day.

When operated at the recommended pressure of from 45 to 50 pounds and with the coil brought up to proper heat by the burning of a wad of paper or waste, the torch will consume slightly more than two gallons of furnace oil an hour. Kerosene consumption is slightly higher due to higher volatility. Repeated tests indicate that, including the fuel used in starting the torch and bringing it up to the proper heat to gasify the fuel, it takes just under 2½ gallons of furnace oil to cover the 7200 square feet of vertical surfaces on the galleries. The fuel consumption is, thus, the extremely small amount of one gallon per 2900 square feet of surface flamed.

With furnace oil costing 8 cents per gallon in small quantities delivered, the entire cost of a complete

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WHAT EQUIPMENT Is Covered by the CONTRACTOR'S BOND?

By John Simpson

This article is devoted to consideration of the supplies of machinery and other equipment used by the contractor and subcontractor on the work; the price paid for same, repairs and replacement parts, and rental of the equipment. The statutes involved may vary somewhat in their phraseology, but, substantially, the question presented is whether these things or any of them are covered by a bond which, as prescribed by the statute, protects the materialman furnishing materials or supplies used upon and entering into the construction of the work. Only the most recent cases decided within the past three years, are here presented in detail. An attempt has been made to give some idea of the general trend of the decisions of the various states prior to that time. Statutes, of course, may be amended from time to time, sometimes for the very purpose of overcoming a difficulty pointed to in a case decided upon the original statute. The Louisiana statute of 1918, amended in 1926, is a case in point.

THERE is much diversity of opinion among the decisions of the various states as to what articles are and what are not included in the statutory bond required to be given by contractors for public works containing provisions intended for the protection of material-men furnishing material to the contractor or his subcontractors for use and consumption in the prosecution of the work.

Purchase Price of Equipment

The general rule appears to be that the purchase price of articles which are actually used in and as part of the construction under contract are covered by the bond, but tools and implements which, while employed in doing the work, survive its performance and can be used upon other contracts, are not covered. In an early case, Beals vs. Fidelity & Deposit Co., 76 App. Div. 526, 78 N. Y. S. 584, affirmed 178 N. Y. 581, it was said that "it would be unfair to those who furnished labor and material legitimately and naturally entering into the construction of a given piece of work, that the liability under the bond should be employed in paying for tools and materials which perhaps might be used upon a hundred contracts."

The rule has been exhaustively discussed in several recent cases in the South Dakota Supreme Court. In Dennis vs. Emke 224 N. W. 925, that court said: "We do not think that the parties contemplated that the purchase price of every tool or every appliance which the contractor bought and made use of in the performance of the contract would constitute a 'claim incurred in carrying out the provisions of the contract.'

"It is a matter of common knowledge that the performance of contracts of this kind requires a plant and equipment suitable therefor, many items of which are expensive and the purchase of which could not be justified by any single contract unless it was extremely large. It is further a matter of common knowledge that this kind of work is generally performed by persons who engage therein as a business and who maintain, for the purpose of the general contracting business, a very considerable amount of equipment intended and designed to be used in that business over a period of several years and in the performance of a number of contracts. We do not think it can be said to be within the contemplation of the parties that the surety on such a bond as this should be liable for the purchase price of tools and appliances which constitute and create, or become a part of, the general plant and equipment of the contractor, as distinguished from those minor tools and appliances which are consumed or practically consumed in the performance of a particular contract."

"In order to create liability on the part of the surety for the purchase price of tools and appliances under these contract bonds, at least the following elements we think must be present. First, the tool or appliance must be purchased specifically and particularly for use in the performance of the particular contract; second, the use of such tool or appliance must be at least proper, if not reasonably necessary, in connection with and about the carrying out of the contract; third, the tool or appliance must be used in or about the performance of the contract; fourth, the tool or appliance must be such that it is reasonably to be expected in the natural course of events that its normal life for the purpose for which it was designed will be practically consumed by its use in or about the performance of the contract, and in this connection the facts of each particular case must be taken into consideration."

The court instanced conceivable cases, one where the contractor had a grading contract running into several millions of dollars which would necessarily take several years to perform, where the surety might be liable for a $10,000 tractor, purchased specifically for that operation, and entirely worn out and consumed therein; and another where the same contractor had a $3,000 grading contract requiring only a few days to complete, and he purchased the same tractor to do it with. In the latter case the surety would manifestly not be liable for the purchase price of the tractor.

In the Emke case the grading contractor on a federal aid project for about $63,000 had bought a second hand tractor which he was paying for at $500 per month. He had used it on another job, and after using it on the federal aid project he used it on other road contracts. It was held that the purchase of the tractor was an increase of the general plant and equipment of Emke in the road-contracting business. It was not purchased exclusively for use on the federal aid project, nor was its usefulness consumed or practically consumed therein, and under all the circumstances its purchase price could not be fairly said to have been a claim "incurred * * * in carrying out the provisions of said contract" within the contemplation of the parties when the contract and bond were executed.

In a later case concerning the same bond, Western Material Co. vs. Emke (S. Dak.) 228 N. W. 385, it was held that the purchase price of substantial items of the contractor's general plant and equipment are not within the bond.

In Dennis vs. Great Northern Const. Co. (S. Dak.) 222 N. W. 269, it was held that if the trial court's finding that two tractors at $2550 each supplied to a road contractor were "practically worn out" in carrying out the provisions of the contract might be said to imply that they were not completely worn out, the surety company, on making payment for same, would be entitled, upon principle of subrogation, to the residual value thereof, if any.

The price of trucks sold to the contractor is not covered by a highway contractor's bond securing claims for "labor or material, "given under section 12, c. 75, West Virginia Code (the Mechanics' Lien Statute). The bond given under this section by a person who contracts with the proper legal body to construct a public structure is held to secure those persons for the reasonable price of such materials, machinery, equipment, and labor sold and furnished by them for which they would be entitled to a mechanics' or laborers' lien if the structure was a private instead of a public one. Morton Motor Co. vs. Fidelity & Casualty Co., West Virginia Supreme Court, 152 S. E. 860.

The purchase price of new trucks bought by the drivers for hauling gravel for graveling a public road and guaranteed by the contractor was not covered as "supplies used or employed on said contract." West vs. Detroit Fidelity & Surety Co., 118 Neb. 544, 225 N. W. 673.

A bucket elevator, screen, and pulleys, belts, lanterns, hose and extension for the elevator, which "were totally used up in the usual and ordinary performance of the contract, so that nothing remained in excess of normal salvage," so that they lost their identity as tools, appliances, implements, and machinery were held covered as "materials" and "supplies." A. L. Young Machinery Co. vs. Cupps, (Cal.) 297 Pac. 538.

"Articles within the coverage of a highway contractor's bond, purchased for use on a given project, and primarily so used, thus substantially contributing to its completion, are secured by the bond without regard to whether they are worn out on the job. But a mere temporary use, although in mind at the time, coupled with a purpose to use it, and the actual use of it wherever occasion arose, will not render bondsmen liable."

Material for the repair of harness for the equipment of mule teams was held not covered, where part of the equipment was used on another job. Singer vs. Anniston Hardware Co. (Ala.) 133 So. 910.

Small tools, such as axes, hammers, and pick handles and harness for mules, are covered by the Alabama bond. Union Indemnity Co. vs. Handley, 220 Ala. 292, 124 So. 876. Small tools are "supplies" within such a bond, although they may ordinarily outlast the work. United States Fidelity & Guaranty Co. vs. Benson Hardware Co. (Ala.) 132 So. 622.

But the Alabama bond does not cover material which is a part of the permanent equipment of the contractor, such as wagons, automobiles or trucks, although worn out before completion of the project. U. S. F. & G. Co. vs. Benson Hardware Co. supra.

If a motor truck purchased for immediate use on a public contract will in the normal course of things serve on others as well, its cost is not within the coverage of the contractor's bond. Clifton vs. Norden, 178 Minn. 288.

The Mississippi bond is held not to cover the permanent equipment of the contractor. United States Fidelity & Guar. Co. vs. Yazoo County, 145 Miss. 378; McElrath vs. Kimmons & Sons, 146 Miss. 775.

Dynamite, fuses and caps furnished to subcontractors and used by them in accordance with the obligation imposed upon the highway contractor by his contract in clearing the ground within the limits of the roadways of all stumps preparatory to the start-in of grading operations were allowed on the contractor's bond. Long Bell Lumber Co. vs. S. D. Carr Const. Co., (La.) 133 So. 438, although these materials were consumed in the prosecution of the work and were therefore invisible except as they endured in tangible results.

The price of railroad crossties and the expense of labor performed by a railroad's trackmen in repairing a spur track of the railroad to facilitate the handling of supplies and materials for the highways were not allowed because not for work done or material furnished that went directly into the highways. Long Bell Lumber Co. vs. Carr Const. Co. supra.

Repairs on Equipment

Some cases hold that there can be no recovery under a public works contractor's bond for labor or materials supplied for and used in the repair of the contractor's or a subcontractor's tools or machinery, either for the reason that such labor and materials do not enter into the structure, or because the contractor or subcontractor is expected to furnish his own equipment as part of the work for which he is consummated. While these cases may not take into consideration whether the repairs are major or merely incidental, the fact that the materials supplied are not, or may not be, from their nature, exhausted in the prosecution of the work, usually appears. Jurisdictions in which such decisions are found are: United States, Alabama, District of Columbia, Indiana, Iowa, Louisiana, Michigan, Mississippi, Missouri, North Dakota, Tennessee, Texas, Washington, Wisconsin.

Missouri Rev. St. 1919, §1040, as amended by Laws 1925, p. 127, requires that contractors for public works give bond conditioned, among other things "for the payment of material, lubricants, oil and gasoline used in or consumed in the construction of such work and for all labor performed in such work." It is held to be the contractor's duty not only to furnish the necessary implements and machinery for the proper execution of the work, but to keep them in order, and therefore that the time and material expended in keeping in repair the contractor's implements and machinery are not expended in the construction of the road and are not covered by the contractor's bond. State rel. Hernleben vs. Detroit Fidelity & Surety Co. (Mo. App.) 21 S. W. (2d) 494.

The items disallowed were bills for spark plugs, gaskets, and other automobile truck parts, and labor for repairs upon machines and machinery, such as graders and plows belonging to or used by the contractor in the performance of his contract.

Under a statute covering "all work done, labor performed, or material furnished in the construction, erection, alteration or repair" of the improvement, the Louisiana Supreme Court holds that the work done or material furnished must have entered directly into

(Continued on page 52)

THE EDITOR'S PAGE

Danger—Men Not at Work

Satan always finds some work for idle hands to do. And if they remain idle too long they become confirmed in either deviltry or laziness, especially if supported by charity or a dole. The great majority of those now unemployed do not want charity, they want work. Private industry apparently can do little more toward furnishing work, and it is up to city, county, state and federal government agencies to do so, to preserve the morale of its citizens as well as their lives.

Such work should be near at hand, so as to avoid the expense of travel to and from it or boarding near it. For federal, state or county governments almost the only work which is widely distributed is highway work—not necessarily construction, but cutting weeds, cleaning and shaping up side ditches and shoulders; removing the hazard of deep ditches by putting pipe in them and covering them with widened shoulders; planting trees along the roadsides for ornament, shade or wind breaks to prevent snow drifts and blowing dust. If any state or county highway official can not think of any really desirable work of this kind needed on his roads, he does not know his job, or is in a self-satisfied pipe dream.

But the requirement of local work for city dwellers, in which are included three-fourths of the unemployed, can best be met by city work. Here again there is plenty to do which wide-awake public works officials know about. Grand Rapids and Indianapolis, among other cities, speak from experience when they say: "Finding jobs was an easy matter, for Grand Rapids had shelved numerous projects in years gone by, largely because of lack of funds; and the chief item of expense connected with most of these projects was labor." While Indianapolis Chamber of Commerce found that "There not only were and are enough jobs to satisfy the needs, but there seems to be an unlimited amount of such work." The former statement was made after more than eighteen months of providing work for about two thousand men, and the latter after eight months' experience with about fifteen hundred (otherwise) unemployed. Details of the experience of these two cities are given elsewhere in this issue.

While the carrying out of these emergency work plans may be in the hands of chambers of commerce or special committees, the selection of the work to be done should be made by the city engineer, city manager or other official in charge of the public works of the city. Only so can work be selected which will produce physical results of the greatest benefit to the city. If he has not already done so, the official holding such position in every municipality of the county should at once prepare definite detail plans for such work, so that if he is called upon at any time he can the next day put gangs of such emergency employees at work that both they and the citizens will recognize as really useful. Not to be able to do so will be a confession of failure to recognize and live up to the responsibilities of his position.

Buy Snow Equipment Now

Two well-known reasons advanced for "buying now" are to help start the wheels of commerce, and because things are cheaper now. Public officials may feel that they are not justified in acting on the former, and that taxpayers and voters would object to anything that increases municipal expenditures; but the latter reason would seem to justify and assure approval of immediate expenditures for whatever is reasonably necessary.

Is the purchase of snow equipment necessary? A few cities have reported that last winter they did not use the equipment on hand in order that they might provide work for more laborers. This seems to us a most short-sighted and foolish procedure. They admit that it cost more per load of snow removed to do all shoveling and loading by hand than to use plows and snow loaders. But assuming they used a thousand men where three hundred plus equipment would have done the work, then the work of seven hundred men was wasted. These seven hundred, however, could have been used for cleaning *other* streets that are not ordinarily cleaned at all, for keeping gutters open, cleaning sidewalks, etc., and thus doing, at no increased cost, much more work than was done by hand labor alone. It hardly seems probable that any city last winter cleaned the snow from *all* its streets; nor that the citizens would not have benefitted if it had done so.

But why should not this additional seven hundred have given still more service for the wages paid them by having equipment to work with? Instead of using no equipment, if additional equipment is provided for next winter, this thousand men will do double the work they could do otherwise.

In addition, there is the element of time. Snowbound streets cost the merchants thousands—in large cities hundreds of thousands—of dollars a day. The additional equipment would enable the main streets to be opened up in half the time required by hand labor, and this saving in time would pay for the equipment in a single winter.

It seems incontrovertible that not only should worn-out equipment be replaced, but that the amount on hand should be increased, if public officials are to make reasonable preparations for the efficient use of the labor that public opinion will expect them to employ when opportunity offers. And this applies not only to emergency snow fighting but to equipment for use in other kinds of work suggested elsewhere on this page. Much snow equipment, in fact, can be used on this other work also.

As to purchasing immediately—most manufacturers in all lines are carrying less stock on hand than usual, and it may take several weeks, plus the time required for freight delivery, to obtain equipment. And in a few weeks winter will be on us. It is not a day too soon right now to place orders for the coming winter's equipment.

SNOW REMOVAL METHODS and EQUIPMENT

In the mountains of Colorado on April 20th

Methods and Equipment Recommended for Snow Removal from Highways and Streets

RECOMMENDATIONS relative to snow handling on highways and equipment therefor were reported by a committee of the American Road Builders' Association at its convention last January. They were based upon information submitted by 23 state highway departments. As they were made public near the close of the 1930-1931 snow fighting season, and so long before the presently approaching one that they may have been forgotten, it seems desirable to publish them at this time. It is not believed that there has been any material change in the ideas of snow handlers in the few intervening months. The report, with some comments brought out during the discussion by the society, is as follows:

Success in Snow Removal Depends Upon

EARLY ATTENTION — ADEQUATE EQUIPMENT
QUALIFIED OPERATORS — COMPETENT CONTROL
CONSTANT APPLICATION — GREATEST SPEED POSSIBLE

With drift prevention and elimination of icy and slippery conditions supplementing the actual removal.

It is recommended:

I. That snow removal equipment be classified as to type at normal operating speeds as follows:

A. *Slow*—up to 5 miles per hour.

B. *Intermediate*—5 to 15 miles per hour.

C. *High*—15 miles per hour—up.

Including in the respective classes*

1. For rural roads or sparsely populated suburban streets.

Class "A," *Slow*—

(a) Tractor operated displacement plows.

(b) Rotary plows.

Class "B," *Intermediate*—

(a) One-way blade, displacement type, truck-mounted.

(b) V-plow, displacement type, truck-mounted.

Class "C," *High*—

(a) One-way blade, speed type, truck-mounted.

(b) V-plow, speed type, truck-mounted.

2. For urban and suburban streets.

Class "A," *Slow*—

(a) Tractor operated displacement plows.

(b) Loaders.

(c) Sidewalk plows.

Class "B," *Intermediate*—

(a) One-way blade, displacement type, truck-mounted.

(b) V-plow, displacement type with and without wings, truck-mounted.

II. That the following improvements be made in equipment.†

A. The attachment features and hitches of plows be standardized so that the several types and makes of plows may be interchangeable.

B. The working surface of the snow blade be polished, treated with rust resisting material and coated with suitable wax to eliminate friction.

C. All equipment be fitted with cabs fully inclosed, tightly built, properly ventilated, roomy and comfortable, and heated, if possible, but not by use of exhaust heaters as built at present.

D. The elimination of the use of exhaust heaters on all snow removal equipment until they have been developed to a point where the danger from exhaust fumes has been entirely eliminated.

E. Suitable provisions be made on all snow removal equipment for the safe conveyance of exhaust fumes away from the cab to eliminate the possibility of contaminating the air in the cab by such fumes.

III. That traffic hazards be reduced by:

A. Emphasizing locations of protruding wing and blade ends by suitable markings, preferably flood lighted at night.

B. Marking the equipment to distinguish it as

*Effective snow removal demands the use of more than one type of equipment on the same road, according to road and storm conditions encountered, and under varying conditions the grouping of equipment according to classes as herein given may not prevail.

†Equipment should be designed to afford the operators every consideration in comforts to obtain the most efficient service. It is important to maintain the high morale of the operating forces under the most trying conditions.

OPEN ROADS
—all winter long

. . . . Keep traffic moving and business going with Cletracs

WHEN winter snows pile up across roads and highways, isolating homes and towns and menacing lives, property and business, there is only one sure way to meet the threat. Modern, efficient snow fighting equipment is the only reliable weapon that can give sure protection.

• • •

Throughout the big snow-belt Cletrac Crawler Tractors are the recognized power units for carrying on this increasingly important winter job. They are built, powered and armored for such heavy-duty service. Broad, sure-gripping tracks for unslipping traction. High power efficiency for handling big plows. Fast travel for quick clearing. Economical operation. Sturdiness. Usefulness for other road work when summer comes. These are just a few of the features that make Cletrac Crawlers the soundest possible investment for public departments or contractors handling the snow removal job.

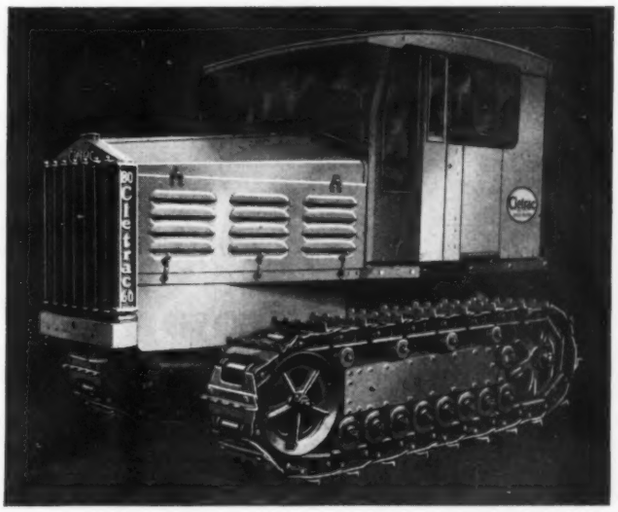
CLETRAC
CRAWLER TRACTORS

Cletracs are adapted for ready attachment to various makes of snow plows, of both the rotary and regular push types. Enclosed cabs and special ice-cleats (both removable) are optional equipment on all models.

• • •

Prompt and expert service is available through your Cletrac distributor. See him for a demonstration or write direct for complete information.

THE CLEVELAND TRACTOR COMPANY
19322 Euclid Avenue Cleveland, Ohio



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snow removal equipment by color, signs or other means.

C. All maintenance equipment should not be required to comply with the regular traffic rules and regulations.

IV. That organization of operating force and distribution and operation of equipment be in accord with the following general practice:

A. That the operating personnel be organized and controlled by supervisors within suitable local areas, and that the operators be selected from the permanent maintenance force assigned to the particular area because of their familiarity with local road conditions. Prior to the snow season the operators should erect *suitable markings* which will remain visible above the snow and indicate to them the location of headwalls and other obstructions.

B. That snow units be assigned to definite sections of roadway; that a reasonable number of replacement units of similar type be maintained for use in case of breakdowns, and that these usual units be supplemented by reserve or emergency equipment for severe conditions.

(No recommendations as to mileage per unit is made because of the variable conditions encountered. Only experience can dictate the equipment necessary for the circumstances to be anticipated in the respective localities.)

C. One-man power graders, although not directly classed as snow removal equipment, may often be used to advantage as supplementary equipment when available.

D. Snow should be removed down to the road surface, if possible.

V. That snow removal programs include, be accompanied or supplemented by, measures to prevent icy or slippery conditions, promptly and rapidly applied by mechanical or other means, to care particularly for steep hills, curves, dangerous intersections and those highways that constitute village or town streets in heavy traffic areas.

(A combination of sand, slag or cinders with calcium chloride in 35 per cent solution has proven practical, the solution being prepared by mixing 100 pounds of calcium chloride with 13 gallons of water to produce 19 gallons of mixture, and applied in sufficient quantity to saturate the piles of aggregate.)

VI. That the formations of drifts be controlled by the erection of snow fence or other means to permit the usual snow removal equipment to operate effectively.

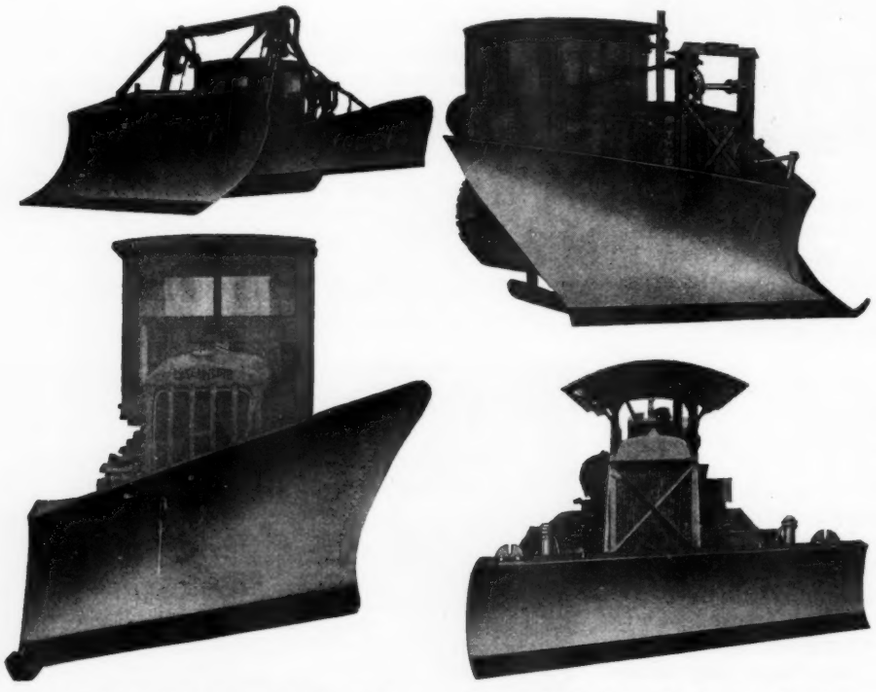
(The location, position of fence and the number of rows at proper distance apart, must depend upon actual experience in meeting local conditions. In some locations, hedge or other shrubbery has been planted in lieu of fence, the advantage being the added beauty.)

VII. That standardized systems be established for keeping costs of snow removal.

(Comparable figures over a period of years would prove of greatest use in improving the efficiency of the respective snow-removal areas in successive years.)

Advances in Snow Removal Equipment

DURING the past year important advances have been made in the design and construction of equipment for snow removal. As the need for and importance of this branch of highway engineering is realized, a greater mileage of roads are annually being kept open. To do this at low cost, promptly and satisfactorily, the best of mechanical aids are needed. There are presented here some of the recent developments by the leading companies in this field.



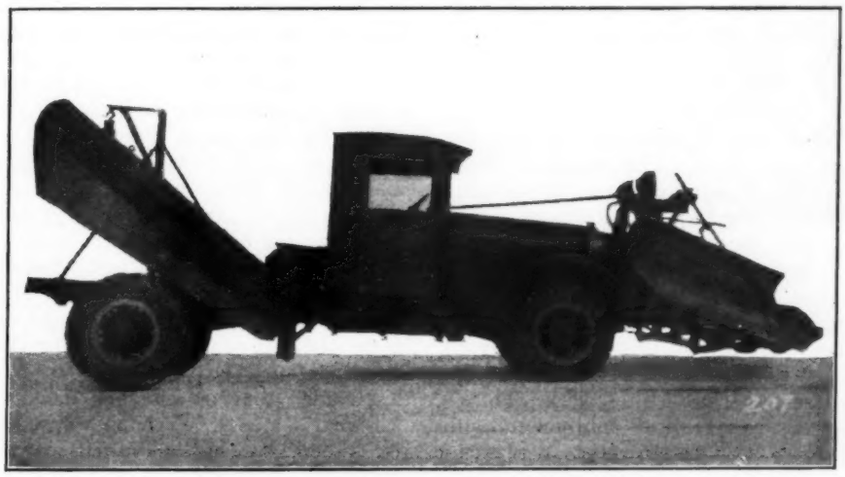
Above—Hydraulic V plow. Below—Sidewalk plow for "10" tractors.

Above—Light-duty hand-operated plow for "30" tractors. Below—Blade plow for "60" tractors.

A group of LaPlant-Choate plows

In addition to the standard heavy-duty blade plow, the Good Roads Machinery Co., of Kennett Square, Pa., is offering this same type of plow with a special high moldboard—36 inches over all. This has proven particularly successful where the snowfall is comparatively heavy and is stated to give excellent results at high speed. Important developments are also announced in a light plow made by this company for use with Ford, Chevrolet and other light trucks. This has been greatly improved by a swiveling caster which takes the weight of the plow off the cutting edge, and also provides for easy vertical adjustment, allowing the plow to be operated with the edge as close to the pavement as desired.

For high-speed snow removal, such as on wide highways or airports, the Good Roads Company



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SNO-PLOWS

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makes a V-blade plow for 3-ton and larger trucks, the Model 21-B, as well as a complete line of other V-blade plows, suitable for all types of plowing. All of these are designed for high-speed work and all are equipped with either standard roller bearing worm and gear lifting device, or the two-speed spur gear chain hoist lift. A pneumatic lifting device also has been developed which is especially desirable on trucks or buses equipped with air brakes.

A variety of types of plows are manufactured by the LaPlant-Choate Mfg. Co., Cedar Rapids, Ia. Four of these are illustrated herewith. The V-type hydraulically operated plow is designed for crawler tractors in all sizes from 10 to 60 horsepower. Complete control of the plow is secured by easily operated levers, and the design of the plow is such as to assure maximum traction for the tractor. This firm also manufactures a light-duty, hand-operated plow for 20 and 30 horsepower tractors, to fill the gap between trucks and hydraulically controlled plows.

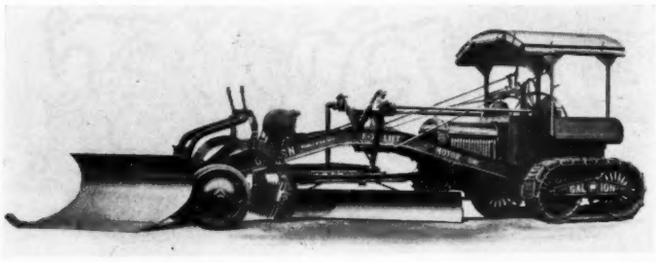
Blade plows also are built by this company in all sizes with hydraulic control, and these same blades can be used on all sorts of bulldozing work. This is exceedingly handy and economical equipment, with almost numberless uses, and is built for all sizes of tractors. The LaPlant-Choate sidewalk plows, which are designed for use on the lighter tractors, show many features for better removal of snow, such as the hydraulic control and a hook on the nose of the plow to raise it over uneven spots in the walk. These units are economical for use around industrial plants, as well for sidewalk and park clearing.

As usual, Caterpillar Tractor Co. says it largely with pictures, and herewith are shown some of their tractors at work on snow removal. New types adapted for this work include the recently announced "Fifty" and new "Diesel," also just announced.

The Empire Plow Co., Cleveland, O., manufactures a line of plows which are novel, and have a wide range of usefulness in that they can be used with any automobile—Ford, Chevrolet, or larger—or with a light truck or tractor. They are quickly attached or detached, and when the snow has been cleared away, the car is free for other uses. These are not designed for heavy highway work, but for clearing drives and roadways in schools, cemeteries, small villages and townships, where the heavier equipment does not go, but where snow removal is just as necessary and just as much a convenience and a paying proposition.

The Barber-Greene Snow Loader is an essential part of the equipment of cities where snow must be *removed* and not merely pushed to one side or thrown over the bank. In these days of heavy traffic there isn't room for parked cars, traffic and a couple of big snow banks, all in one street. Business finds that it pays to remove the snow, instead. The machine shown is one belonging to the city of Aurora, Ill., working in the blizzard of last March. The Barber-Greene Co. says that such satisfactory work has been done by this loader that no changes have been made from last year's model. Perhaps we should not therefore list it here, as this is limited principally to new or improved equipment.

The Galion Iron Works & Mfg. Co., Galion, Ohio, has developed a Galion snow plow or breaker to increase the efficiency of their motor grader as a snow mover for moderate depths of snow. The plow opens a six-foot path for the grader; the blade following widens the path and moves the snow to the outside of the road. This attachment of the plow is very simple and, with the grader, makes a most efficient all-year-round tool for the highway engineer. The plow is combined with and operated by the scarifier mechanism, so that raising and lowering is very easy.



Above—Galion motor grader equipped with plow. Right—Caterpillar Sixty with rotary "Snow King" in Michigan. Caterpillar Ten with broom in Outremont street. Caterpillar Fifteen with Wausau snow plow in Traverse city. Below—Barber-Greene loader in Aurora.

Water Purification With Ultra-Violet Radiation

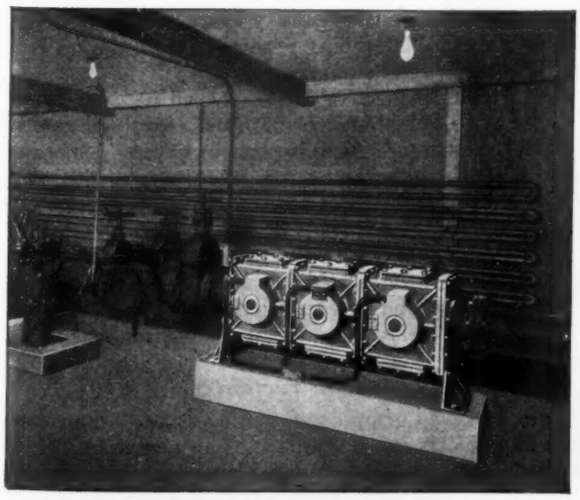
By J. F. Springer

EQUIPMENT relying upon ultra-violet light for the destruction of germs in water supplied for drinking purposes and other domestic uses has been installed in a number of communities, a few of which are in the United States. Of the installation at Berea, a municipality near Cleveland, Ohio, considerable exact information of comparatively recent date is available. Other ultra-violet installations have been made at Horton, Kansas; Perrysburg, Ohio, and elsewhere. At the city of Eureka Springs, Arkansas, six of the springs have their water sterilized by ultra-violet rays.

This method of purification is perhaps not adapted to any and all conditions. It is necessary that the water subjected to treatment be in a clarified condition. But this requirement ought to be imposed anyway; so that it is not to be charged up against the ultra-violet procedure. The process does not clarify, nor does it decolorize. Its one service consists in killing the germs. This it does, and does well. And apparently, it kills just about all the known kinds that are apt to be present in water.

The water will perhaps be no safer, from a health point of view, than water that has been thoroughly treated with chlorine. But there is, apparently, a superiority over chlorination with respect to certain waters from the point of view of taste and odor. The ultra-violet procedure perhaps has not been tested out yet so fully as has chlorination, so that a comparison of a thoroughgoing character does not appear possible. However, chlorine in water will at times be objectionable, particularly if the water also contains any phenol.

Prof. Blocher states, in his account of experiences at Berea, that investigations carried on at the Baldwin-Wallace College yielded no evidence of any chemical change taking place during the ultra-violet treatment. In a general way, the treatment is producing no objectionable tastes or odors.



Sterilizer installed for City of Horton, Kansas.

Ehlers and Steel, in their work, "Municipal and Rural Sanitation," 1927, say of the ultra-violet method of sterilization that "The process, however, has the advantage of destroying not only bacteria but spores, and effects this without danger of tastes or odors resulting from overdosage." In this connection, it is desirable to emphasize the point that it is not possible to give an over-dose. We have here a clear superiority to those methods which depend upon the addition of powerful chemicals.

Experiments were made to determine the effect of the rays upon a certain micro-organism which grows plentifully upon clay in streams that are near Berea. Upon exposure, this organism is killed apparently without any delay at all, and by the end of the second second the body structure collapses and soon disintegration becomes severe. Prof. Blocher thinks it likely that something similar occurs when bacteria are exposed.

Necessary Equipment

The equipment necessary comprises a compact device, known as a sterilizer. There may be a battery of these, all similar to one another. The water, already limpid, enters on one side and passes out on the opposite one. During its pasage through, sterilization takes place. The apparatus requires direct current; so that, if purchasable current is of the alternating variety, it is necessary to use a rectifier or a generator. If the latter is used, operation may be secured by the alternating current, steam or some other source of power.

At Berea, there are now eight sterilizing units. They began with four and then added another four. Originally they generated their current, using a motor. Later, this motor-generator was replaced by rectifiers. The new group of sterilizers were built in series and placed parallel with the older units. The occasion of the replacement of the generator by the rectifiers was the destruction of the former by a serious flood in July, 1924.

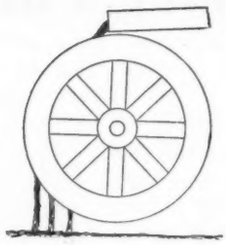
In each of the box-like sterilizers, a source of ultra-violet light is installed. That is, an electric arc, produced in an atmosphere of mercury vapor and housed in a transparent tube of fused quartz, is installed in a position such that the baffles, also placed in the sterilizing chamber, direct the flowing water past the arc. The ultra-violet radiation produced by the arc penetrates the near-by water and performs its function of killing the micro-organisms. The direct electric current is employed to maintain the arc.

Naturally, the efficiency with which the germicidal action goes on depends more or less upon the time of exposure. If it is deemed desirable, it is not necessary to limit the flow to 4 units. The water may be sent through the whole battery.

The cylinders are cleaned at intervals of 3 to 6

(Continued on page 51)

THE WATER WHEEL



By
Jack J. Hinman, Jr.

The essential features of important articles of the month having to do with water works design, construction and operation, and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

DESIGN

CERTAIN areas in Utah have lately suffered considerably by the transportation of vast amounts of **debris and earth** by mountain streams after heavy rains, burying roads and farmlands. Check dams have been placed in the gullies and canyons to control the debris movements and, according to Winsor[63], have been successful structures. **Silt** accumulates back of the check dams. Such accumulations are undesirable where dams are to be used for impounding water for irrigation, power, or water supply, since the water capacity is reduced. Reed[62] describes the tunnels used in some Swiss installations for **by-passing debris-laden floods** to prevent them from dropping their loads behind the dams.

Models are being used extensively in the design of dams and other structures. If the model is to give results which can properly be employed in the design, the relationships need to be carefully considered mathematically. Stevens[45] gives a clear and simply explained discussion of the way in which correct dimensioning may be secured in the models.

Many cities are following the lead of Detroit[98] in the construction of **elevated tanks** floated on the system for the purpose of securing a sufficient storage of water in areas difficultly served during the hours of greatest demand. In **Wauwatosa, Wisconsin,** storage of water at ground level at the plant provides a place where aerated water can deposit the precipitated iron and also lower its hydrogen sulfide content by oxidation. Elevated tanks are expected to help **Milwaukee** defer the construction of additional pumping stations[26]. There are no heights in Milwaukee sufficiently great to allow the reservoirs proposed to be set directly on the ground. Where such reservoirs can be installed, the suggestions regarding their design assembled by Chester A. Smith[87] may be helpful.

Beckwith[88] has found **centrifugal** pumps doing duty for which they were not designed, because they had been purchased at bargain rates. He calls attention to the fact that centrifugal pumps are designed to be used under fixed conditions and that any material departure therefrom is usually followed by a greatly **decreased efficiency.** He provides some simple schemes by which the "wire to water" efficiency may be determined. The **Diesel engine** can compete with large power plants in economy of operating pumps, but except where the power rates are exceptionally high, the isolated small steam plant can not do this, in the opinion of C. F. Lambert[173]. Such economy makes the Diesel engine increasingly popular.

British water engineers have been studying **failures of water mains** since the many breaks during the severe winter of 1929[55]. Failures were most common in the smaller sizes. Vibration, tampering by agencies other than the water authority, and removal of protective cover in grading roads were contributory. **Saint Louis** has recently dug up some cast iron water main **laid in 1858** and found it to be in excellent condition[118]. In Boise City, Idaho, cast iron pipe is being used to distribute water from hot water wells[113]. The water is at a temperature of 170°F. as it comes from the ground and is decidedly corrosive. The cast iron pipe supplants wood and other metal pipes. At San Juan, Texas, it was found cheaper to install a **reinforced concrete pipe** six feet in diameter than to line an existing canal with concrete[60]. The pipe was cast along the line in steel forms producing sections six feet long. **Asbestos cement pipe** sold under the name of "Everite" is being made in England[126]. It is made in sizes up to 18 inches diameter, with straight ends requiring separate joint bands.

In the design of **house piping** the friction in small pipe may become very important, since a loss of ¼ to ½ pound pressure may be due to a single elbow[50]. Too much resistance is also likely to be introduced by a ⅝ inch meter[92] if **flushometers** are installed in the residence served. At least a ¾ inch meter is needed. Flushometers should not be installed where the supply is derived from mains smaller than 6 inch. **Lawn sprinklers** of the buried pipe type are being installed in many places. The piping requires special design[49].

Articles of Special Importance:

Hoover Dam project described, Mead[74].

Part of **velocity head** for high velocity flows may be recovered through the hydraulic jump. Shooting velocities introduce unusual phenomena, Scobey[47]. Ford Motor Company's new **tunnel** being driven rapidly[59].

DeLavaud process of centrifugal casting of pipe has interesting history, Clark[120].

Calculating pipe by equivalent size, Mann[73].

Graphical analysis of dual flow problems, Palsgrave[69].

Construction

The reserved grounds of well fields and other water supply projects can be utilized as **airports** if the structures necessary can be made level with the ground surface. Such use is a desirable auxiliary one, in the opinion of A. H. Heermance[89]. The presence of water under pressure is very valuable for fire protection since most airports are located beyond the reach of city mains.

46 miles of DELAVAUD PIPE are in use for gas and water mains

The progressive spirit of Springfield, Massachusetts is exemplified by a beautiful civic center with a magnificent campanile tower. Springfield's progressiveness is also evidenced by its gas and water systems for which 46 miles of deLavaud pipe have been specified and laid.

For deLavaud pipe is the strongest pipe ever cast. It is a tough pipe too. The metal is dense and fine-grained — remarkably free from slag, blow holes and weakening impurities. Tests conducted by disinterested testing laboratories have proved that deLavaud pipe is at least 25% stronger than good pit cast pipe.

DeLavaud pipe is produced by pouring molten iron into a rapidly revolving cylindrical mold. Centrifugal force holds the metal against the sides of the mold and drives out impurities with a force many times greater than gravity. DeLavaud pipe is a modern pipe for modern conditions and present-day high-pressures. Ask us for facts and figures. The new deLavaud Handbook gives detailed information. Write for a free copy today.

The self-centering shoulder in the deLavaud bell eliminates the requirement of a bead. In laying deLavaud pipe it is only necessary to place the spigot of one pipe within the bell of the next, sliding the pipe forward until it rides upon the taper and automatically centers itself.

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Articles of Special Interest:

A new Lake Erie supply is being planned for **Toledo, Ohio**[n67].

The **Albany, New York,** impounded water supply is complete and can furnish the city with 65 million gallons per day[119].

The **Hackensack Water Company** is about to begin a million dollar improvement program[n2].

Guilford pumping station at **Baltimore** described, Small[90].

Publication describes public **water supplies of Ohio** and effect of drought on them[n172].

Sorel, Quebec, has a new 3mgd. Norwood filter plant[37].

Application of **St. Croix Water Co.** to raise dam not yet acted upon[n32].

Cuban water supplies are handicapped by low dry-weather stream flows, Pierce[152].

Two charges of explosives brought down the **water tower** at Fort Slocum, Vandevanter[106]. Methods of **underground alignment** of waterworks structures discussed, Barnett[130].

36-inch conduit jacked under three 4-track main railroad lines at Hammond, Indiana[116].

Current American practice. **Corrosion. Sandspun pipe,** etc., Carey[131].

Well Supplies

Temperatures of ground waters would reach 212°F. at 16,200 feet, according to Shank,[140] if a uniform increase of one degree per 100 feet descent took place. This depth has not been reached by the drill. At that depth the pressure would be 478 atmospheres and the water would not boil, until the pressure was relieved.

Lowering of ground water in wells at **Los Angeles** has amounted to fifty feet in the last 25 years. Of this, twenty feet of drop has occurred within the last five years. The city, according to Lane[91], has been developing an additional supply of ground water in the southern portion of its territory. Water in the chalk at **London, England,** has dropped from about sea level to 150 feet below. In the last 18 years the level had fallen 43 feet at the Strand and even more in the vicinity of the Bank of England.

Articles of Special Interest:

New Kelly Wells at **Regina, Sask.,** Bennison[29].

Layne gravel-packed well increases supply of **North Battleford, Sask.,** Coil[27].

Oasis Cotton Co. secures new artesian well with flow of 20.55 cfs. at depth of 843 feet in **Roswell, N. Mex.,** artesian basin[n147].

Artesian well at **Slough, England,** yields ½ mgd. from Lower Greensand[135].

Principles of well construction described, Fiedler[128].

Fishing tools for use in wells illustrated and described, Fiedler[84].

Operation

The pioneer plant to attempt to produce **water of drinking water quality from sewage** was probably that at the Grand Canyon, Arizona, so far as the United States is concerned. The sewage plant at **Barrington, New Jersey**[64], is treating 600,000 gallons of sewage per day to this point, or very close to it, though the chief reason for the treatment is to avoid nuisance during two miles of flow in a small stream running through a populous district of the city. **Los Angeles'** experiments carried out under the direction of Wilson and Goudey are described by Robertson[82]. Preliminary figures indicate that with a 25 mgd plant, instead of the 1/5 mgd experimental one, the purification can be effected at a cost of $24.56 per million gallons, not including a saving of $5 to the sewer department. This is a cost of about 1.5c per cubic foot instead of the 3 or 4c which the water from the Colorado river is expected to cost delivered to Los Angeles consumers. **Waste brines from zeolite water softeners** have been one of the more troublesome wastes encountered in this study. The water will probably not be used for drinking purposes, but for an industrial supply. At **Baltimore** the treated sewage has fostered an annoying **growth of algae** in the stream which receives it[n165]. Chlorine and lime will be used in an effort to restrain the algal growth. Copper sulfate has not been successful.

At **Beverley Hills, California,** the water works had to be built in a high-class residence district. This necessitated its being ornamental in architecture with its function disguised. Hydrogen sulfide removal was also required and the gas could not be merely blown out into the air. Indoor aeration through Sacramento type nozzles, chlorination and the destruction of the hydrogen sulfide in a tower were accomplished. Softening is part of the treatment of the water, which comes from a series of wells[4].

Crooksville, Ohio, had a **high iron** water, which contained **manganese** in addition. Aeration, contact treatment and filtration did not remove the objectionable metals. Conversion of the works to a lime-softening plant also secured the removal of the iron and manganese from the water[n149]. Robert Spurr Weston prefers **contact aeration** for manganese removal and has found it generally satisfactory[137]. Some **complex organic iron combinations,** notably the citrate and tartrate, which may be expected to occur in a few waters of moorland origin, are not broken up readily by treatment with lime[129]. Some waters are particularly difficult to treat in standard manner but usually are capable of improvement when thoroughly studied[95], [105].

The **ammonia-chlorine treatment** continues to attract attention because of its ability to prevent chlorophenol tastes and to retain the germicidal power of the chlorine for longer periods[150], [41], [42]. Periods over two hours are necessary for the germicidal power of the ammonia-chlorine combination to equal or exceed that of chlorine alone, according to Gerstein[161], at least when Chicago city water is concerned.

Bay City, Michigan, is one of those cities where **activated carbon** has effectively removed offensive taste from the water supply[147]. The chemical has been used in the form of filters[133] and also as a **fine powder** applied to the water at some point in its course through the treatment plant. The carbon is best applied to the water leaving the sedimentation basins on its way to the filters, if adequate time and mixing are available[151].

Spaulding[101] at Springfield, Illinois, has found that when just enough lime is used to convert the calcium and magnesium bicarbonates to normal carbonates, any change of **lime dosage** is quickly indicated by a change in the pH of the water, while when the dose is raised to give an excess of about 40 ppm. lime and a pH of 10.8-10.9, to remove magnesium as the hydrate, the magnesium causes a **buffer action** to be exerted. In both cases he has had incrustation of the sand and conduits after carbonation of the water to convert unremoved calcium and magnesium back to the bicarbonate. **Magnesium silicate** scale has been deposited in the hot water boilers as a soft but adher-

(Continued on page 59)

Water Purification at Cameron, Missouri

By Bennett B. Smith

CAMERON, Mo., population 3,500, originally installed a water supply to be used for fire protection and lawn and garden sprinkling only, unfiltered water from a lake being used. In 1919 crude purification was begun consisting of mixing alum and lime in vats and allowing the solution to drip into the water, which flowed through a mixing chamber and settling basin, the process being in charge of a low salaried, inexperienced man.

Before many months had passed this was found to be unsatisfactory, and better equipment was added to make the water safe for drinking. Two Wallace & Tiernan chlorinators were installed, three filters each with a capacity of 250 gallons per minute and a 60,000-gallon clear-water well. Since then additions and improvements have been made at intervals. A new-style chlorinator is an improvement over the old ones, one of which was retained as a stand-by. At present the plant has a capacity of 1,000,000 gallons a day, although the demand is only 125,000 gallons.

At center, water works settling basin. At lower left, wire mesh aerator. At upper right, cooling tower for engines.

An unusual feature of the plant is an aerator which was constructed locally and is perhaps an improvement over commercial types. In this the usual pans are replaced by wire screening, which breaks up the water, giving it more complete aeration, and screens out foreign matters.

Maintenance Organization in Louisiana Highway Department

The maintenance department is one of the nine principal departments of the Louisiana highway commission. It is under the supervision of an assistant state-highway engineer, who, in turn, is directly subordinate to the state highway engineer. Directly under the assistant state highway engineer in charge of maintenance is an assistant maintenance engineer, followed by twelve district superintendents; the latter are directly in charge of the twelve maintenance districts of the State, and the numerous work, or patrol, units. Each district superintendent has an office centrally located in his district—the district headquarters. Each district is divided into a number of maintenance, or patrol units, to each of which is assigned a particular section of highway to repair and improve, the average length of these sections being about 36 miles.

A typical patrol unit consists of a unit leader (usually a truck driver), one or two gradermen and several laborers. The equipment generally assigned to a unit consists of a large truck or tractor for motive power; two graders for blading the surface and ditching; one or more light trucks for hauling gravel, binder, etc., and a number of small tools, such as shovels, axes, etc. There are about 220 such patrol units in the State, besides one or more gravel or truck fleets to each district.

An equipment inspector periodically visits the various units, and it is his duty to see that all machinery, equipment and tools are properly repaired, greased and kept in workmanlike condition.

Red Water

Probably the most frequent cause of complaint against the public water supplies obtained from wells is concerning the iron content in the water which causes so-called "red water." Data collected by the State Department of Health from 221 Ohio municipalities which use well water untreated show that 100 of these municipalities have a water supply in which there is an objectionable iron content.

In most of these 100 municipalities the water, when first pumped from the wells, is clear because the iron is dissolved in the water by the carbon-dioxide in it. On exposure to the air, the carbon-dioxide is released from the water and the iron precipitates in the water, turning it a reddish color. Such water discolors plumbing fixtures, stains clothes if used for laundry purposes and is undesirable for some culinary uses. Such water is sometimes not desirable even for sprinkling because it stains concrete or stone walks and any metal or stone ornaments. At a few places the iron content of the water is so great that about the only advantage of the public water supply is that it is wet and can be used to put out fires.

The iron content of a water supply has no relation whatsoever to its sanitary quality. A red water, however, is unsightly and may be unpalatable to some persons. These factors may cause people to use unsafe private water supplies and hence the iron-bearing public water supply, even though it is safe, may have an indirect deleterious effect on the health of the community.

Treatment plants to remove iron from water have been in successful operation for many years. Most of the more recent plants are combined iron-removal and water-softening plants, since it costs but little more to install a plant for these combined purposes than it does to install a plant merely to remove the iron.

Residents in cities and villages where red water occurs may rightly inquire of their municipal and waterworks officials why investigation has not been made to determine the nature and costs of the improvements necessary to remove the iron from the water. When this information is secured the citizens can then determine whether the bond issue or slightly higher water rates necessary to finance the improvements meet with the approval of the public.—Ohio Health News.

Illinois Resurfaces

63 23/100 MILES WITH BRICK

ILLINOIS began a brilliant chapter in highway economy this year, by widening and resurfacing worn concrete roads with brick.

A total of 63.23 miles constituted the initial program.

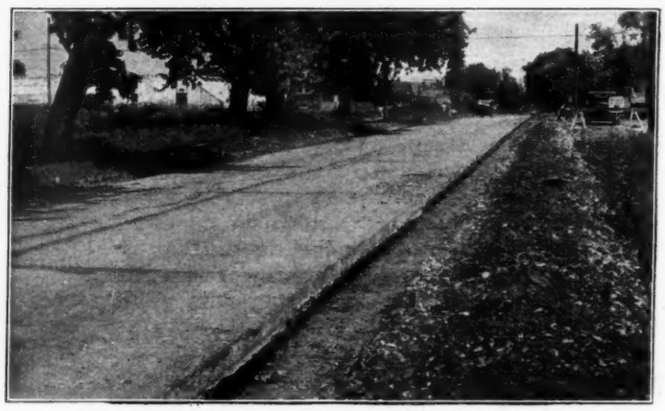
Thus, slabs that have not too far approached the end of their usefulness are being saved for many years to come. *Brick* pavements built 30 and 40 years ago are in constant use today, although not nearly so well constructed as these Illinois brick resurfaced sections.

The economy and sound judgment in resurfacing with brick is apparent. The worn concrete—unsatisfactory as a pavement—will make a good base on a subgrade that has received its full settlement. Mastic cushion and bituminous filled brick surface prevent transmission of cracks. Weather and traffic will have no effect on the brick surface. The existing slab has been transformed into a low-maintenance road extraordinarily well suited to all traffic.

Highway engineers, officials and taxpayers will find much of interest in this Illinois work.

Further information on resurfacing with brick may be had by addressing the National Paving Brick Association, 1245 National Press Building, Washington, D. C.

Completed brick resurfacing of worn concrete by Illinois State Highway Department on Route 4 south of Springfield. This gives the highest type highway at low cost.



Worn slab being prepared for curb and brick resurfacing.

Photos by courtesy of Division of Highways, State of Illinois

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HIGHWAYS and PAVEMENTS

Finishing Concrete Sidewalks

By T. A. Day

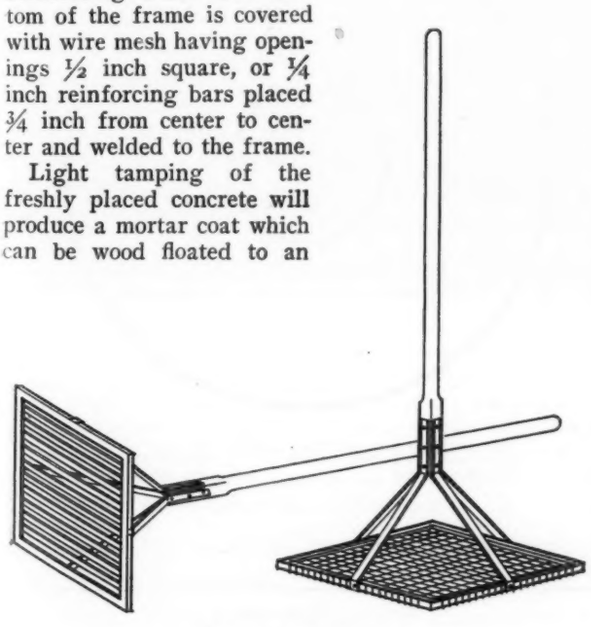
It was once common practice to build concrete sidewalks and similar work in two layers—that is, a base course and a wearing surface. Engineers and contractors, however, are now more than ever before turning their attention to the advantages of one-course construction, and everyone, especially the property owner, welcomes the savings which this type affords.

If difficulty is experienced in producing a one-course sidewalk easily and economically, it usually is due to improper proportions of the fine and coarse aggregate used in the mixture. It is not difficult to finish a mix in which a total of 6 gallons of water per sack of cement has been used if the maximum size of aggregate is 1½ inches and the ratio of sand to coarse aggregate is approximately 2¼ to 3.

If a larger proportion of coarse aggregate is used it may be difficult, if not impossible, to push the coarser pieces of aggregate into the mass and bring enough mortar to the surface to produce a satisfactory finish. To overcome this difficulty, several Texas contractors have developed tampers which force the coarse aggregate below the surface and raise sufficient mortar containing the coarser sand particles to the surface for finishing.

Most of these tampers are about 18 inches square and built on frames of small size angle iron or ½-inch reinforcing bars. The bottom of the frame is covered with wire mesh having openings ½ inch square, or ¼ inch reinforcing bars placed ¾ inch from center to center and welded to the frame.

Light tamping of the freshly placed concrete will produce a mortar coat which can be wood floated to an even surface. Where a smoother finish than that given by a wood float is desired, the surface should be left undisturbed until the shiny film of surface water has disappeared. This waiting permits the mortar to set up enough so that the steel trowel will not pull the fine sand and cement particles to the top. When these fines are drawn to the surface they have a tendency to produce dusting and hair checking in concrete work. A smooth, polished surface can be produced with only a few strokes of the trowel over this partially hardened mortar.



Concrete Tampers

Bituminous Surface Mixing Method on Nevada Roads

The Nevada Department of Highways has since 1927 been developing a method of reconstructing and oiling gravel-surfaced roads that were becoming unserviceable, based upon the California method but with variations to meet the requirements peculiar to Nevada's climate.

Briefly, the method consists of scarifying, adding crushed gravel to give the desired thickness, and blading; making three applications of fuel oil totaling ½ to ¾ gallon per square yard per inch of penetration, thoroughly mixing the oil and loose material by means of discs and spring-tooth harrows after each application; blading the material into a central windrow, flattening this and mixing with disc and harrow, blading back to the sides, and repeating this until the mixture has a uniform color, generally requiring at least 20 passages of the blade grader. If the stain test shows that the mixture contains too much oil, the base course is scarified lightly and mixed with the surface material; if more oil is needed, it is distributed on the surface mixture after it has been spread evenly. The mixture is then bladed back and forth until a true surface of uniform color is obtained, and the top inch is again harrowed, bladed, mixed and spread. It is compacted by traffic, the surface being kept smooth by use of a small blade grader or light road planer at least 16 ft. long. If fat spots develop, they are loosened and additional gravel mixed in; if lean spots, oil is applied.

"As the type of surface obtained by the foregoing treatment is non-rigid, it is essential to drain all waters from the roadway section, and especially from the supporting grade, to eliminate capillarity and subsequent failure. Wherever the soil in the supporting grade is high in capillarity, it is also necessary to break the bond between the treated surface and the sub-base soil with a mat of selected gravel and sand; otherwise the life of the treated surface is very short and it is impossible to maintain a smooth surface. To obtain the best results it is important to control

the small factors which enter into the work as well as the major operations.

"Each succeeding year the Department has added refinements to the work, such as increasing the depth of treated material at the sides of the road, improving surface and shoulder drainage, remixing the top inch of finished material for a wearing course, dragging and rolling to promote compaction."

Maintenance Organization and Methods in Illinois

The maintenance of surfaced roads is arranged by types and divided into patrols. The patrols are grouped as maintenance sections averaging about twenty miles in length, which is a convenient length for one patrolman to maintain.

A supervising patrolman is assigned in charge of about six to eight maintenance sections. He is responsible to the district maintenance engineer. The supervisor must approve the employment of laborers to assist the maintenance patrolman in the performance of his duties and the district engineer's approval is also needed when an unusual amount of help is required.

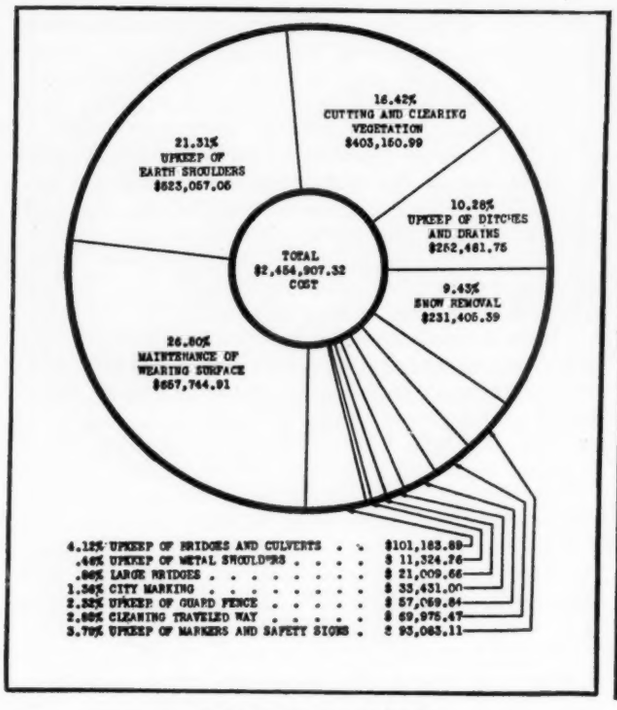
The district maintenance engineer, who is in charge of all maintenance work in the district, is responsible to the district engineer who in turn reports to the Engineer of Maintenance.

The equipment furnished to each patrolman consists of a truck, tar kettle, road grader, road drags and such other small tools as may be necessary for the repairing or replacement of damaged wearing surfaces. Each patrolman is held responsible for the keeping of his equipment in serviceable condition and is required to make periodical reports of same to his supervising patrolman. In each district other equipment is available for the patrolman, such as concrete mixers, tractors, traffic line markers, mowing machines, snow plows, etc., for the maintaining of his patrol.

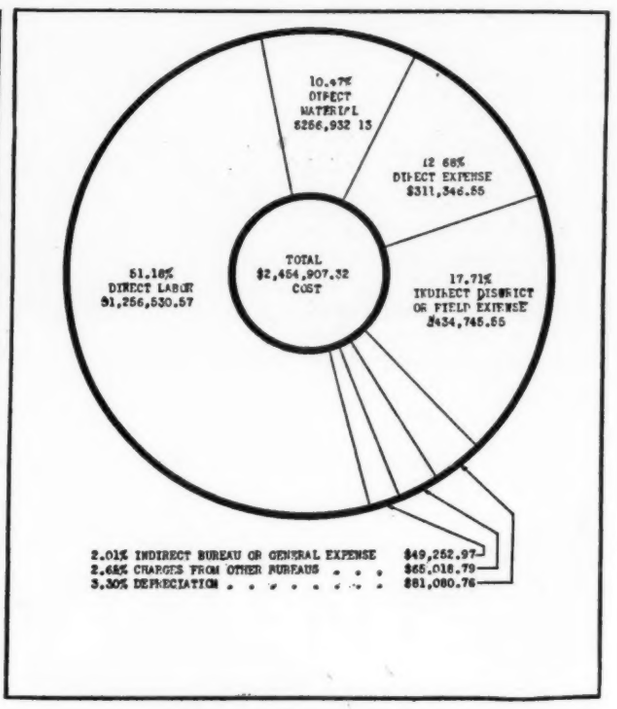
The narrow cracks and breaks which occur in concrete pavements are generally repaired with asphalt, sand and gravel. Depressions or surface settlements are built up to a uniform grade with asphalt, gravel, stone or chips. The portions of the wearing surface damaged beyond repair are replaced with new construction. The ruts and eroded places in the earth shoulders are filled with earth and dragged smooth. In the case of some of the heavier traveled roads where excessive ruts have developed, gravel, shale or crushed stone is placed along the edge of the pavement. Weeds are cut and the shoulders mowed during the summer and fall. Ditches and culverts are cleaned systematically to provide the necessary drainage. The right of way is cleaned and cleared of objectionable growths, such as bushes and limbs of trees. The maintenance of surfaced roads also includes repairing and replacing of route markers and safety signs; painting of the traffic line; repairing, repainting and replacing guard fence; repairing, cleaning and repainting bridges, removal of snow and the filling of expansion joints with asphalt.

Cheap Road Construction in North Dakota

Under the heading "Bargains in Road Building" the North Dakota Highway Bulletin tells of low bids received July 31st for road grading and graveling. Gravel hauling was awarded at 6½ cents per cubic yard mile, earth excavation at 15 cents per cubic yard, and concrete for bridges at $16 per cubic yard. "In 1920 we paid as high as 62 cents per cubic yard for earth excavation and from $40 to $45 per cubic yard for concrete. Gravel hauling in 1919 was let at 40 cents per cubic yard mile." No recent prices were given for comparison.



By Classification of Work



By Cost Components

Charts showing division of costs of the Illinois Bureau of Maintenance for the year 1929.

NET FACTS *about* CONCRETE *cured with* CALCIUM CHLORIDE

» » » « « «

Reported by the Committee on curing of concrete pavement slabs to the Tenth Annual Meeting of the Highway Research Board, December 1930.

1702 Specimens, Tested by 12 State Highway Departments and 3 Independent Organizations, Showed High Average Strength . . . . . .

The percentage figures in bold face type show the average strength obtained by concrete Cured with Calcium Chloride (surface method) as compared with the strength of corresponding concrete cured with wet earth or straw. For the purpose of the comparison the strength of the wet earth or straw cured concrete is fixed at 100%. The figures in parenthesis are the number of specimens tested in each case. In studying these comparisons, it is well to remember that the concrete cured by wet earth or straw in these tests was accomplished under conditions better than ordinarily exist in field practice.

	TABLE II			TABLE III			TABLE IV		
	Cured with Wet Earth or Straw Days	Ages of Tests Days	Cured with Calcium Chloride Field Flexural Tests %	Cured with Wet Earth or Straw Days	Ages of Tests Days	Cured with Calcium Chloride Field Compressive Tests	Cured with Wet Earth or Straw Days	Ages of Tests Days	Cured with Calcium Chloride Laboratory Flexural Tests
Bureau of Public Roads	13	3 to 180	**90%** (16)						
Georgia Highway Dept.				10	210	**94%** (8)			
Illinois Highway Dept.	14	28-60	**102%** (30) a				10	28	**95%** (9) d
Illinois Highway Dept.							14	28	**98%** (6) d
Iowa Highway Dept.	9	7 to 365	**95%** (450) g	9	8 to 365	**96%** (60) g			
Minnesota Highway Dept.	2-6	7-28	**94%** (12)				3-10	7 to 90	**93%** (30) h
Missouri Highway Dept.	7-28	7-28	**98%** (10) f						
Missouri Highway Dept.	10	21 to 91	**92%** (18)						
New Jersey Highway Dept.	10	7-28	**95%** (16)	10	28	**95%** (6)			
N. Carolina Highway Dept.				10	120	**93%** (22)			
Ohio Highway Dept.	9	4 to 28	**94%** (30)	9	90	**92%** (9)			
Ohio State Thesis							10	7-28	**114%** (12)
Portland Cement Ass'n	7-14	7 to 90	**92%** (15) b				13	14 to 365	**99%** (16) d, i
Portland Cement Ass'n			**84%** (20) c				13	14 to 365	**117%** (16) d, i
Rhode Island Highway Dept.	10	7 to 90	**106%** (12)				Table V Laboratory		
Tennessee Highway Dept.	10	3 to 28	**96%** (624)	10	365	**97%** (52) g	Compression Test		
Tennessee Highway Dept.	10	3 to 28	**88%** (48) e	10	365	**96%** (4) e			
W. Virginia Highway Dept.	10	28	**92%** (10)	10	28	**95%** (5)			
Wisconsin Highway Dept.	7	28-90	**99%** (18) g	7	90	**103%** (6)			
Wisconsin Highway Dept.				7	28-90	**92%** (12)			
Averages		Table II	**95%** (1329)		Table III	**95%** (284)	Table IV **100%**(73) V **117%**(16)		

Combined Average Tables II, III, IV and V—1702 Specimens—95.4% (Compared with wet earth or straw cured concrete)

(a) 3 lbs. of Calcium Chloride per sq. yd. (b) Beams molded and cured in concrete forms (c) Beams molded and cured in wood forms (d) Specimens left in forms until tested (e) These specimens received no rain during first 10 days (f) Specimens removed from forms at 24 hours, 3 sides and both ends coated with thick asphalt. Calcium Chloride sprinkled on surface (g) Specimens tested wet (h) These specimens placed in constant temperature 70°F. and Humidity (70%) storage until test (i) Specimens soaked before test.

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Calcium Chloride Publicity Committee

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The Dow Chemical Company, Midland, Michigan

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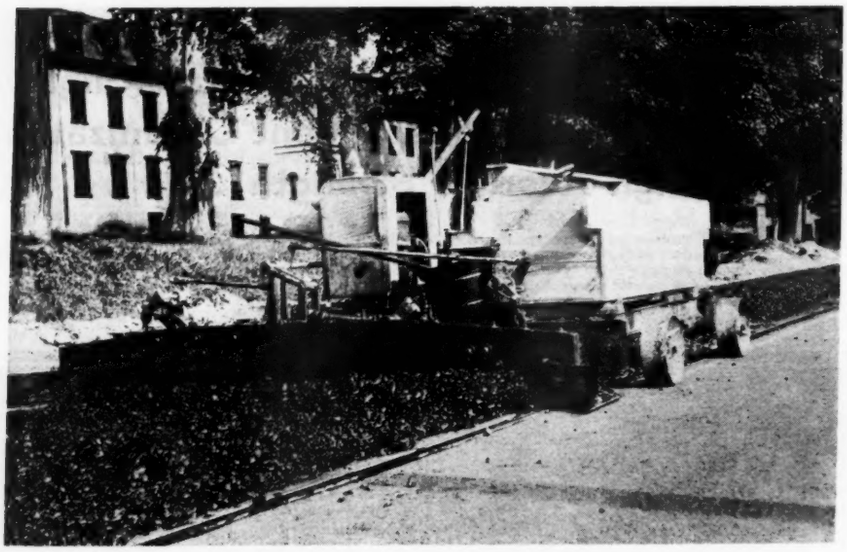
PW 10-31

Widening and Salvaging Old Concrete Road

(Continued from page 18)

On this job, the surfacing is taken in trucks direct from the plant to the job without delay. The plant operates at its full capacity, and about 2800 yards a day have been laid.



This is the way things looked when the gang knocked off for lunch. Note forms.

Charles Carris is superintendent for the contractors. W. H. McGonigle is assistant engineer in charge of the work for the state.

Snow Notes From State Departments

(Continued from page 26)

and gives the necessary traction. Pennsylvania applies the calcium chloride as a solution, a 35% soluton being poured over piles of cinders, giving them all they will absorb when thoroughly mixed, which cinders are then spread on the ice.

Most of the states start fighting snow as soon as two or three inches have fallen and keep at it twenty-four hours a day until the storm has stopped and the roads are cleared. But several note exceptions. In the northern part of Indiana, in the case of a very severe storm with very high winds, the men are instructed to delay removal until "the forces of the storm have been spent, then while they are fresh and vigorous they can attack the blocked highways and open them up for traffic quickly." In the adjoining state of Illinois, however, when drifts get too heavy for one truck a pusher truck is hooked on, and when these no longer can get through, hand shoveling and crawler tractors are used; in some severe storms with high winds roads may be blocked by drifts three or four times in succession in a few hours, but they continue to fight them. Michigan believes that "in the case of blizzards, it is real economy to forego attempts at plowing until the storm has let up to a point where visibility is not a serious handicap.

In Illinois, the Springfield office receives reports of a storm from all parts of the state and is often able to forecast its route and give several hours' warning of the approach of a storm to districts not yet affected.

South Dakota finds that "a comparatively light snow fall followed by a high wind will cause more trouble than a heavier fall with less wind. It is the depth and length of the drifts that determine the class of equipment that must be used." A V-plow can buck through fairly deep and long drifts, but for the worst conditions a V-tractor plow or rotary is necessary. After a storm a single track is opened up through the heavier drifts, followed up by a heavy tractor plow or rotary to clean the road entirely. The "Cat" rotary is run onto a heavy trailer hauled behind a powerful 4-wheel truck carrying a V-plow, which clears the road, and bucks through the drifts and leaves the rotary to widen these out while it clears the undrifted road ahead, then comes back and picks up the rotary on the trailer and runs ahead speedily to the next drift, where the operation is repeated.

On roads near Chicago, Illinois has sometimes experienced nearly as much trouble from cars abandoned in drifts as from the drifts themselves.

Colorado can not keep all roads in mountain passes open, both because of the cost and especially because of the danger from snow slides. "The ever-present danger of snow slides would not only render the work of snow removal extremely hazardous to the lives of the personnel engaged in that snow removal, but would also leave a tremendous hazard for traffic using the road after the snow had been removed and before the snow slides run." The snow slides occur at the same places almost every year, at any time before April 1st.

Michigan removes ice from drainage structures by use of steam, the equipment being a portable steam boiler, usually mounted on a trailer, sufficient hose to reach from road to structure, and a nozzle.

Snow Fences

Most states use more or less mileage of snow fences, especially in localities where there is a consistently "prevailing wind." Illinois finds that the fence will not completely eliminate the need for plows but will so reduce drifting that the lighter equipment can keep the road clear; and that fences would be uneconomical in the southern part of the state where the snow fall is light.

Montana finds snow fence very effective. They use the rule of a one to ten slope to determine the distance of fence from road. Others adopt different distances varying from 50 to 150 feet, but mostly between 60 and 100. Ohio uses about 200,000 feet of snow fence, which has enabled them to "replace heavy V-plows and rotary plows with the high-speed blade plow, permitting a more efficient and quicker snow removal."

South Dakota favors a liberal use of snow fence as an economy. Many conditions affect the location of the fence. "Whether the land is grass land, wheat stubble, or fall-plowed makes a difference in the way the snow will pile up. Ordinarily about 70 feet from the back slope is sufficient but in some cases 80 to 100 feet is needed."

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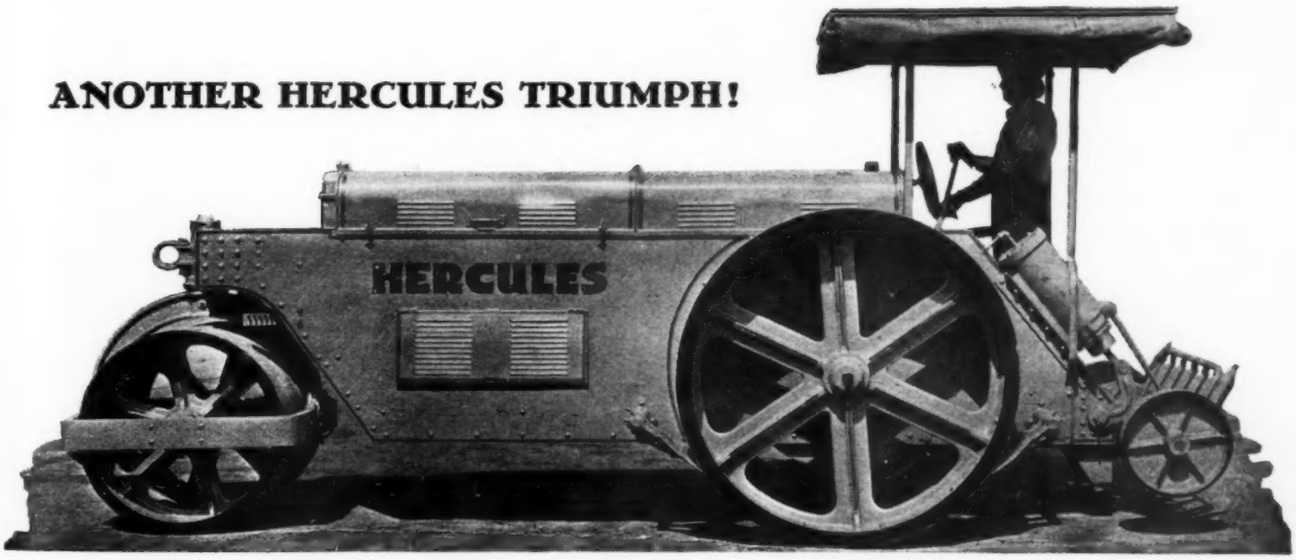

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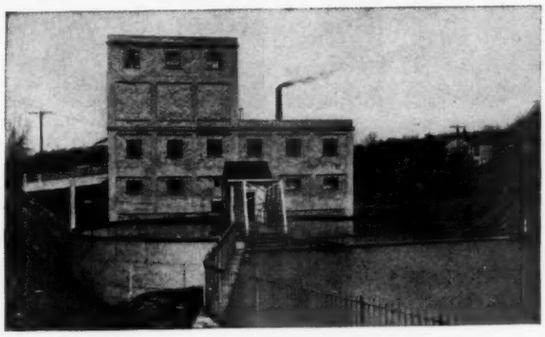

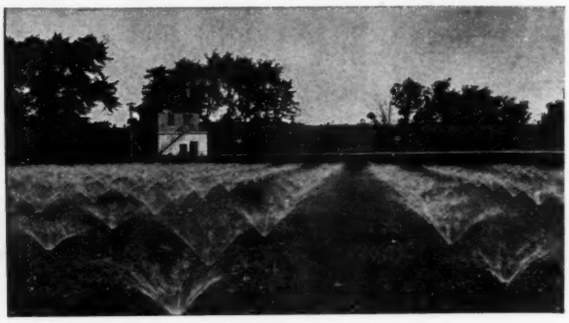

Sanitary Engineering

Methods of Thawing Water Works Services

As stated in another article, 663 cites have reported to us whether or not they are using lead or copper pipe, and what methods they employ for thawing them. Of these, 310 use lead services and 251 use copper ones. (All but 64 of those using copper have lead services in use also.)

A number of states of course are free of the necessity of thawing services because of their geographical location. In addition to these, quite a number of cities report that their services are all placed below the frost line and have never frozen. One, at least, digs up every service it finds frozen and lays it deeper.

Several cities leave it to the consumer and his plumber and apparently concern themselves very little about it. The majority of cities and companies, however, feel that, even if not legally or even morally responsible, it is good policy to help the consumer solve his troubles.

How practicable it is to avoid freezing of services is indicated by the fact that, of all the New England cities reporting, sixteen percent say they never have frozen services; and the same is reported by 6 cities in Michigan, 5 in Wisconsin, 5 in Minnesota, 1 in Montana and 2 in Washington—all states along the Canadian border; also by one in Ontario.

Of the cities using lead services, 180 report that they do more or less thawing. Of these, 141 use electricity for this purpose, but 3 of them use hot water also, and 3 others use steam also. Of the 39 which do not use electricity, 22 use steam, 10 hot water, 5 use torches and 2 use "heat" in a manner not specified.

Of the cities using copper services, 140 report doing more or less thawing. Of these, 108 use electricity, 3 of them also using hot water, 2 steam and 1 the torch. Of the other 32, 15 use steam, 15 hot water, and 2 the torch.

Next to the prominent part that electricity plays in thawing of services—78% of the cities which do any thawing report using it—perhaps the most interesting fact brought out is that, of 378 cities reporting on this point, 149 never have any frozen services. Only 55 of these are in the southern states, so about 29% of those subjected to freezing weather never have frozen services; many of them explaining that they place the services below frost, some of the northern cities specifying 5½ feet depth.

Treatment of Wool Scouring Refuse.

At a meeting in March of the Yorkshire District of the (British) Association of Managers of Sewage Disposal Works, considerable attention was given to the subject of treatment of wool scouring refuse. C. C. Beedham, chemist of the Bradford Corporation Sewage Department, described experiments carried out with the sewage of Bradford, which contains large quantities of wool-scouring liquor—averaging perhaps 200 to 1000 p.p.m. of grease and being at times of a yellow, suddy appearance with an oxygen absorption figure of 700 to 800 p.p.m. The grease is removed by sulphuric acid precipitation.

The best precipitation was found when the sewage was just acid to methyl orange—50 to 100 p.p.m.; but when it was very strong, more acid was necessary. Best results require a gentle mixing, keeping the precipitate intimately mixed with the acidified sewage for a few minutes and then allowing it to settle. If the agitation is too vigorous the colloidal matter is dispersed and the effluent is worse than if there is no mixing.

He found the addition of a little sludge to the mixing tank very helpful in removing colloidal matter.

Experiments were made in treating the effluent on filters and by activated sludge. Based on oxygen absorption from permanganate, it was found that for each of these, good results required the sewage to be less acid, with a pH value just below 7. In Bradford the cost of adding an alkali was avoided by mixing with the acid-treated sewage raw sewage from another district of the city which is strongly alkaline, dyeing and bleaching of cotton being the prevailing industries there.

W. L. Thomas, of Woolcombers, Limited, and J. W. Adams described another method; Mr. Thomas saying that filtering the 60,000 gallons per day discharged at one of their plants required more space than they had available; while Mr. Adams described the acid-cracking process is inefficient in recovery of by-products, no attempt being made to recover the potash salts and only 40 to 50 percent of the grease being recovered, and that worth only 40 percent as much a ton as natural wool grease.

In describing the new method, Mr. Thomas said that after removal of the sand by means of a sump fitted with a 3-4 cwt. grab, the liquor was pumped to overhead tanks. It was then reduced to one-tenth its original volume, *i.e.*, 300 gallons per hour, by a

Kestner quadruple effect evaporator, which returned approximately 2,400 gallons of distilled water per hour at a temperature of 140-150 deg. F. for re-use in wool-washing. The use of this distilled water effected a saving of soap and alkali.

The plant was run continuously for twenty-four hours a day with a total staff of one foreman and six shift men. A 40-h.p. turbine ran the pumps, etc. There had been a lot of difficulty due to the condenser water pump making up, but by getting a more suitable type of pump they had got over the trouble. There was also a tendency for the evaporator tubes to choke, and cleaning had to be undertaken about once a month.

The 300 gallons of concentrated liquor, having a percentage total solids content of 30 to 36, grease 11 to 15, and an alkalinity of 3.5, was passed forward for centrifugal treatment to separate the grease.

Mr. Thomas explained the failure to follow up this process years ago as being due to the lack of an efficient centrifugal machine. The separator would not recover the necessary amount of grease. There must be a sufficient revenue to make the cost of treatment reasonable, and though the original centrifugal machines yielded a satisfactory greasy emulsion, they were choked by dirt in twenty minutes. Mr. J. W. Adams then designed and patented a machine which produced an emulsion amenable to further treatment, and which also required less frequent stoppages for cleaning. This machine ran continuously quite easily for a whole day. The grease produced from the final centrifugal machine was excellent, conforming to B.P. standard lanoline. Though it had a slight smell and the colour was slightly "off," it could be bleached and deodorized without serious difficulty.

Finally, the 300 gallons of liquor from which the grease had been recovered was calcined in a rotary furnace, resembling a large rotary kiln. The liquor possessed sufficient calorific value to be self-combustible once the furnace had been heated. The calcined residue consisted chiefly of potash from the natural suint of the wool.

Mr. Adams, explaining the machine referred to, which he had evolved after long experiments, said that mechanical separation of grease from waste liquors could not be effected in one centrifugal machine. The grease left the first machine as an emulsion containing 60 or 70 per cent of wool grease, and this was passed on through successive machines before the final product of pure lanoline was obtained.

Water Purification With Ultra-Violet Radiation

(*Continued from page 39*)

weeks. The question of the interval turns on the character of the water itself. These quartz cylinders may be cleaned when the units to which they belong are not immediately in service.

Prof. Blocher tested results obtained, 60 per cent of the samples tested being secured half a mile or more from the point of sterilization, and many from dead ends, and reported after-growths as negligible.

Cost of Operation

The cost of operation arises principally from superintendence, labor and current. At Berea, a superintendent is in direct control of all work connected with the light and water supply. As this includes superintendence of the production of light, of the operation of the filters, and perhaps other matters, only a fraction of his time is chargeable against sterilization. An engineer and fireman are on duty all the time, but this expense for labor also may be set down only in part against the operation of the ultra-violet plant. The equipment used for ultra-violet sterilization is readily operated, and no technical labor is required.

We come now to expense for current. In May, 1929, the ultra-violet plant operated for 692 hours, an average of 22 1/3 hours per day. As 20,535,000 gallons of water were pumped, we asume that this represents substantially the amount sterilized. Of the eight units, four were in service. The electric meter showed that 4,090 kilowatts were consumed by the 24 rectifier lamps and the 4 mercury vapor lamps. Prof. Blocher says: "The cost, therefore, was not prohibitive."

A year after the installation of the rectifiers, Prof. Blocher said: "The cost of mercury vapor lamps has been reduced to the vanishing point. The Tunglar rectifiers supply a very even flow of current to the lamps, and not one has burned out since the rectifiers were installed a year ago."

The municipality of Berea owns both the light and water plants. The whole is practically under one roof; and naturally this concentration operates to reduce expenses.

The eight sterilizing units have a total capacity of something over 2,000,000 gallons per day, or 84,000 gallons per hour.

Some Figures from Berea (1930 Data)

In a personal communication of recent date (March 20, 1931), Prof. Blocher gives some interesting figures and information relating to power consumption and costs for the year 1930. These data refer to Berea, whose population is 5,691, according to the recent census. I modify his language slightly:

Enclosed you will find data regarding the amounts of water pumped and the cost of the ultra-violet treatment. The light plant and the water-works are owned by the city. The light department charges the water department 2½ cents per kw.hr. for the current used for the pumps and the ultra-violet equipment.

The following calculations have been made from the data:

1. Cost per year for ultra-violet current	$830.75
2. Cost per day	2.28
3. Cost per capita per year	0.14
4. Cost per 1,000,000 gallons	4.52

Two lamps were replaced during the year. I have no data regarding their length of service.

The method continues to give results that are highly satisfactory.

The current is manufactured at about 1 cent per kw.hr.; so that, while the above charge is made on the books, the actual cost to the people is very low.

Prof. Blocher reports the gallons of water pumped for 1930 as 183,712,000 gallons and the consumption of current for the same period as 33,230 kw.hr.

Cost of Sterilizing Equipment

Municipal units are made in capacities of 1,000,000 gallons per 24 hours. Where more than this is to purified the water is run in parallel through the proper number of million-gallon units. This machine is a bronze casting, tin dipped and all trimmings chromium plated. The life of such a machine is thought to be practically indefinite. The cost of one sterilizer complete, with quartz lamps, control apparatus and motor generator for transforming the

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The expense of operation consists chiefly of power consumption and renewal of the quartz mercury vapor lamps. All other items of expense are said to be practically negligible. The power consumed per million gallons of water treated is 84 kw. hours. The average cost of quartz lamp renewals is given as about 70 cents per million gallons.

The price of $4,500 includes a motor generator, and therefore, the price of rectifiers would not be added to this price. It does not seem to be customary to furnish rectifiers on large installations because the cost of first installation of the rectifier is greater, and also the cost of maintenance is greater than a motor generator on large capacities.

(To be continued)

What Equipment Is Covered by the Contractor's Bond?

(Continued from page 32)

and must form part of the improvement constructed, to give the claimant a cause of action against the surety. Work done and material furnished in repairing machinery used in constructing the improvement is not covered.

Materials and labor used in the operation and repair of a dredge and its machinery employed in constructing a canal and the express and freight charges on the material furnished were not covered. John H. Murphy Iron Works vs. United States Fidelity & Guaranty Co., Louisiana Supreme Court, 124 So. 768,169 La. 163.

Parts and tires and articles used in the repair of trucks used in the construction of a highway are held covered by a bond under Act. No. 224 of 1918 (amended by Act 271 of 1926) which covers "materials or supplies for use in any machine used in the construction of any road." The amendment of 1926 was no doubt intended to broaden the meaning of the act, in view of Red River Const. Co. vs. Pierce Petroleum Co., 165 La. 565 and State vs. Smith, 167 La. 302, and some Court of Appeal decisions; and "in" as used in the act, evidently has the meaning of "on." Rester vs. Moody & Stewart, Louisiana Court of Appeal, 130 So. 254. (1930.)

Lumber sold to a subcontractor for repairs to the subcontractor's pile driver damaged by the carelessness of the subcontractor's employees, who allowed it to turn over, and not for repairs necessitated by ordinary use, or by wear and tear, were not covered by a bond under this statute. Madison Lumber Co. vs. Crane Service Co., (La. App.) 129 So. 189.

In some cases where the bond covers labor and materials used in the prosecution of the work, recovery has been allowed for repairs on the contractor's or subcontractor's equipment, although these were of such a nature as to add to the general plant. Hicks vs. Randich, 106 W. Va. 109, 144 S. E. 887. Other cases allow recovery for repairs without stating whether the repairs are incidental or major in their nature.

The contractor borrowed two "sticks" to repair his steam shovel and purchased two to replace them which were sent to the lender. The lender was held not protected by the bond. The sticks for which the surety would have been liable were those borrowed and used in the construction, which were paid for by those purchased from the claimant. Tuelson & Co. vs. Hill & Co., 196 N. C. 494, 146 S. E. 135.

Other decisions hold that where the repair is on such a large scale that it adds materially to the contractor's or subcontractor's general plant, the claim is not covered by the contractor's surety bond; but, if it is minor and incidental, and substantially exhausted in the performance of the contract, it is within the bond.

Jurisdictions in which this has been held are: The federal courts, Alabama, Minnesota, Nebraska, Oregon, South Dakota.

The incidental repairs to machinery, pipe, and fittings for washing the gravel for a highway, erections of a temporary nature necessary for the use of the crusher, incidental repairs to the motor trucks used in conveying the gravel to the work from the crushing plant, although not wholly consumed in fulfilling the road construction contract, were held covered by a bond under Idaho C. S. §7341. Clothing, such as gloves, etc., and tools, not consumed or destroyed in the work, were not covered. State ex. rel. White vs. Storm, Idaho Supreme Court, 287 Pac. 689.

The Alabama bond does not cover major repairs on the contractor's permanent equipment, but it does include such small and incidental repairs as result from ordinary wear and tear of the appliances used in performing the contract. United States Fidelity & Guaranty Co. vs. Benson (Ala.) 132 So. 622.

Labor and materials used in repairing trucks used by the owners thereof who had contracted to haul gravel for the contractors for gravelling a public road at a stated price per yard per mile were held covered by the terms in the contractor's bond "supplies used or employed on said contract." West vs. Detroit Fidelity & Surety Co., 118 Neb. 544, 225 N. W. 673.

But permanent repairs constituting a betterment to such trucks, such as a new radiator, were held not proper charges against the surety.

"The purchase price of substantial items of general plant and equipment are not within the bond, but if the value of the use of equipment hired is a proper charge against the bond, and we think it is, we think it may equally well be said that expenditures for repairs to keep the equipment in operating condition are likewise within the bond, even though the purchase price of the particular equipment as such would not be."

Claims for parts and repairs to a tractor used in the performance of the contract were held to be within the bond, where the repair items were necssary to keep the tractor in operating condition, and were of an incidental and comparatively inexpensive character, representing only ordinary wear and tear or the equivalents thereof. Western Material Co. vs. Enke (S. Dak.) 228 N. W. 385.

While under the rule of Muller vs. American Bonding Co. 133 Minn. 336, 158 N. W. 432, there may be recovery on a public contractor's bond for material and labor used in incidental and current repairs of the contractor's machinery, the Minnesota Supreme Court holds, Clifton vs. Norden, 178 Minn. 288, 226 N. W. 940, that there can be no recovery for major parts involving replacements of old with new parts, in the absence of proof that the new parts were consumed in the work covered by the bond. The determinative distinction is between items going into the work or specially contributing to its execution and nothing else, and those properly chargeable to the plant and equipment of the contractor and available not only for the pending work but for others as well.

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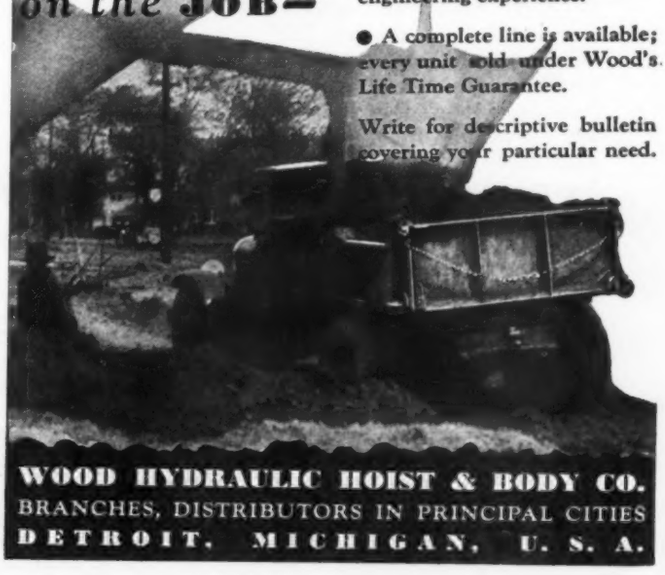

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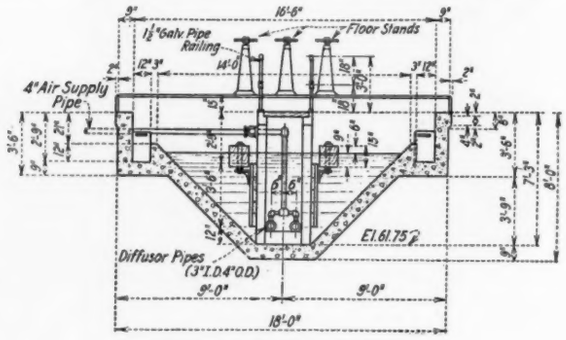
Woonsocket's Activated Sludge Plant

(*Continued from page 25*)

provided with four V-notch weirs which serve as deviators to the aeration tank compartments. This flume receives that part of the activated sludge which is returned to the aeration tank to help in conditioning the sewage.

The aeration tank was constructed of such capacity that, reckoning 25 per cent of return sludge, a detention period of six hours is obtained. There are four separate compartments, each 18 feet wide and 180 feet long, and holding 12 feet depth of sewage, connected up in series so that the sewage flows through 720 lineal feet of channel, being given a spiral motion meantime.



Section of Skimming Tank.

At one side of each compartment a longitudinal baffle of 2-inch plank, parallel to and 2 feet from the wall, forms an air lift channel 2 feet wide. The bottom of the baffle is 2 feet above the bottom of the tank, and through this 2-foot opening the sewage enters the channel, rises, and flows back into the tank over the top of the baffle. Two air diffusers spaced 12 inches apart centers rest on a shelf in the channel about 4 feet below the surface of the sewage, and receive compressed air through overhead pipe lines. These diffusers are formed of Norton porous tubes, 24 inches long, 3-inch bore and ⅝ inch wall, made of porous refractory material through which the compressed air escapes in small bubbles and mixes with the sewage, causing it to rise. The top of the air lift channel is contracted in width to give greater velocity to the air and sewage mixture as it flows over the partition wall. The ends of the diffuser lines are closed with caps and each line bolted together for its entire length. Each pair of diffuser lines is fed through a single air connection fitted with a stop valve to permit regulating the volume of air or, if desired, shutting off any pair of units for cleaning or repairs. Two air manifolds are provided, one for each two compartments.

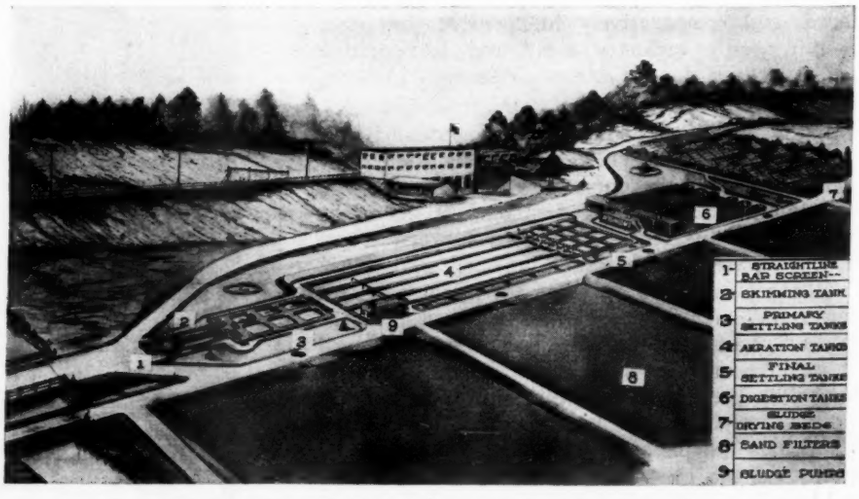
In order to prevent short circuiting of the sewage, each compartment of the aeration tank contains four wood cross diaphragm walls, over or under which the sewage must necessarily pass in going through the tank. A minimum of 1500 cubic feet of air per minute is required for circulation, equal to .7 cubic foot of air per gallon of sewage.

The construction of the aeration tank allows for changing the place of introducing the returned activated sludge at any time. The section of the tank before the point of application of the sludge is used for pre-aerating the sewage with no sludge, for the purpose of freshening the sewage and driving off gases which are harmful to the more tender organisms of the return sludge; the engineers believing that comparatively short periods of pre-aeration without the returned activated sludge reduces the biochemical oxygen demand as much as 30 to 40 per cent.

After being aerated, the sewage passes over a baffled weir and enters the final settling tank where, figuring normal flow, a detention of about two hours is provided. This tank is divided into four compartments, each 18 feet wide and 60 feet long, and holding 9 feet depth of sewage. Mechanically-operated sludge scrapers draw the sludge into hoppers located at the receiving end of each compartment. To allow for occasional flushing out, a perforated water-flushing pipe is set around each hopper.

Sludge is removed from the hoppers through a vertical sludge pipe which discharges into a sludge withdrawal compartment, the bottom of which is 12 inches below the normal sewage level. Inside each sludge pipe was installed a sliding decanter made of a piece of 10-inch brass pipe into which was cut a V-notch weir. This slides in a flange which is bolted to the sludge riser pipe, and the top is capped to provide attachment of a threaded stem which is operated by a floor stand. The amount of sludge withdrawn is determined by the height to which this decanter is raised. On each side of the sludge withdrawal chamber a sludge channel was constructed, one being used to return activated sludge to the aeration tank, and the other to return sludge to the primary settling tank. Through this channel also, should poor sludge appear, it can easily be discharged to the main sludge drain pipe.

The activated sludge from the final settling tank is piped to the sludge return pumphouse, located near the aeration tank, where it is pumped to any desired compartment of the aeration tank. The sludge pumps are of the vertical, low-speed type, operated by motor. The volume of sludge pumped can be varied through a man-operated, variable-speed control. Venturi tubes are provided, with air-driven in-



General layout of Woonsocket sewage treatment works.

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dicating manometers, so that the volume of return to each compartment is measured and controlled. Excess activated sludge is removed by a main sludge drain to the digestion tanks.

The effluent from the final settling tank passes through an effluent main to the fourteen slow sand filter beds used with the former sewage system. In the effluent main, the sewage is chlorinated both to destroy bacteria and to condition the sewage for filtering on the sand beds, where it is clarified and receives some nitrification.

All sludge removed by both primary and secondary settling is disposed of in separate sludge digestion tanks, heated by burning the gas generated therein.

The sludge digestion tanks are in two separate units, each unit being again divided into three separate compartments, each 15 feet deep, 15 feet wide and 90 feet long. In each of the six compartments, mechanically-operated scrapers are used for scraping not only the bottom of the tank but also the underside of the roof, which will loosen the scum and move it toward the inlet end of the tank, where it can be flooded with raw or digested sludge or with water, as desired.

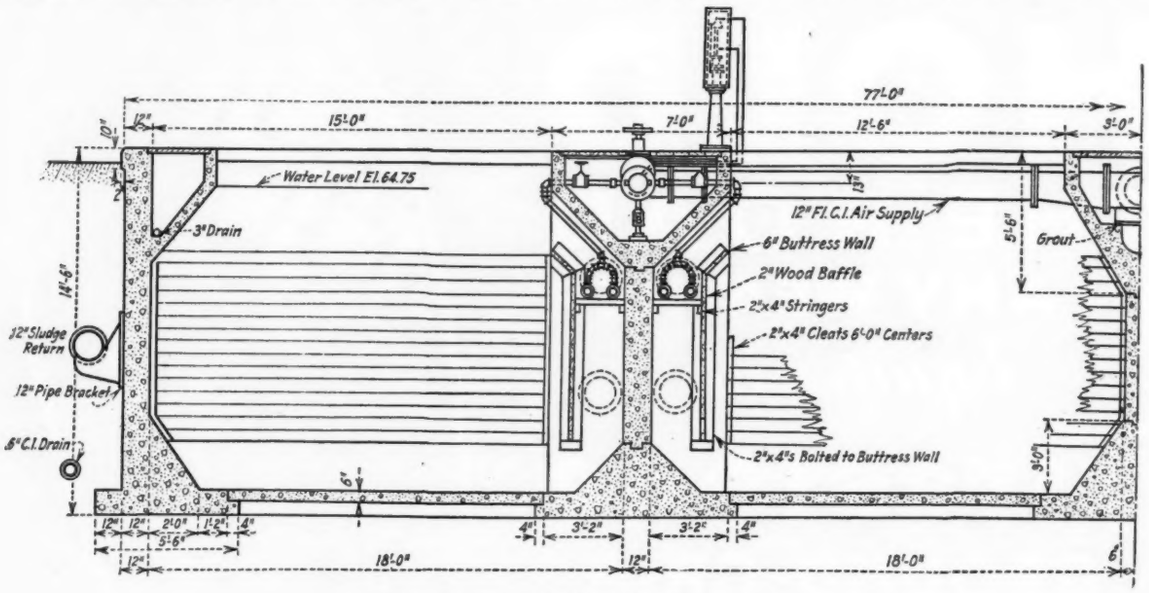
To allow for accumulation and removal of gas as well as to provide for the flow of sludge, the inlet end of each compartment was raised. By means of an adjustable decanter, operated by a gas-sealed indicating floor-stand in the top of the tank roof, supernatant or subnatant fluids can be drawn off to an inspection manhole. Also digested sludge can be drawn from each compartment to an inspection chamber.

Gas formed during digestion collects at a sealed outlet, whence it is piped to a condensation trap, through a gas meter and a fire trap, and finally to the boiler. To relieve pressure caused by too large a volume of gas, a pressure relief tank was installed. Hot water from the boiler is distributed through heating coils slightly above the center of the sides of each compartment, the volume being regulated evenly by manometers and thermometers built in each compartment. The boiler has 3600 square feet capacity, with the usual automatic devices for relieving pressure, measuring water, etc. Motor-operated, circulating pumps working at the rate of 6,000 gallons per hour are used. Digested sludge from the digestion tanks is piped to sludge drying beds, half of which are open ones used with the old plant, and the other half glass-covered. The entire drying area is 240 feet long and 125 feet wide, divided into twelve separate compartments, six being glass-covered.

A small track and switches provide conveyance for serving the beds. For removing sludge, gasoline-operated dump cars are used. Dried sludge is to be used to some extent by the city in its parks, while some will be given to farmers and the remainder will be used for filling in surrounding lowlands.

The entire cost of the plant was about $365,000. Fish, Rutherford, Inc., of Philadelphia, was the general contractor. Equipment was from the Link-Belt Company. The Roberts Filter Manufacturing Company was sub-contractor for the aeration units. Although operating figures have not been proved, it is expected that the plant operation, including power, labor, upkeep and chemicals, will run about $25,000 a year.

The plant capacity was based on an estimated city population in 1940 of 60,000. It now serves 40,000 population through 55 miles of sewers, varying in size from 8 inches to 36 inches in diameter. There are 4,648 sewer connections now in use.



Cross-section of half of aeration tank.

Dry weather capacity, based on serving a 60,000 population, is figured at 3 m. g. d. for 24-hour average flow; 3.9 m.g.d. for 12-hour average flow; and 5 m.g.d. for the peak hourly flow. These figures will jump during rainy weather to 3.6 m.g.d. for a 24-hour flow; 4.5 m.g.d. for 12-hour flow; and 7 m.g.d. for hourly peak flow.

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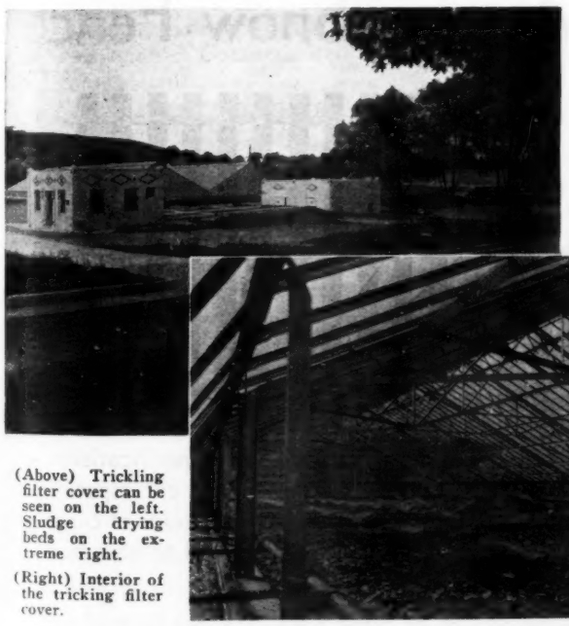

(Above) Trickling filter cover can be seen on the left. Sludge drying beds on the extreme right.

(Right) Interior of the tricking filter cover.

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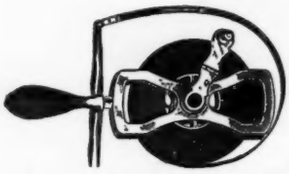

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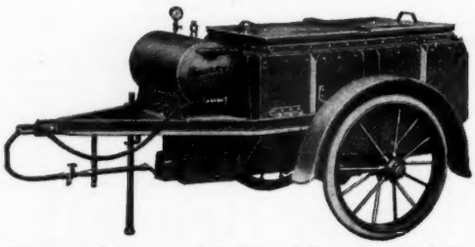

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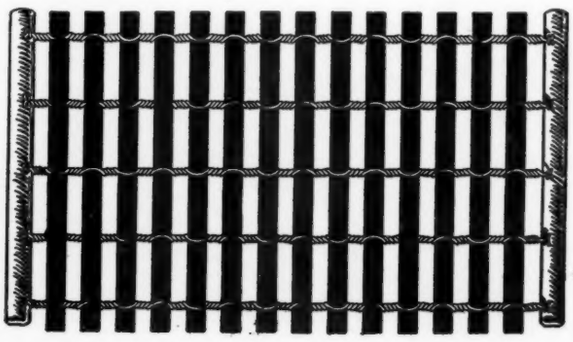

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The Water Wheel

(Continued from page 42)

ent deposit after excess lime treatment. Spaulding has found the sterilizing effect of lime slower than the commonly used chlorine. Recarbonation is accomplished with flue gases. In small plants the apparatus for carbon dioxide generation is very simple. At Crooksville, Ohio, it is merely a small stove connected to a scrubber and compressor[157]. At softening plants the water is commonly pumped to consumers with a pH of 8.5 to 9. At Baltimore, Baylis added lime to bring the water of the filter plant to about that point with the idea of **preventing corrosion** of the piping.

The conventional **washing** procedure for rapid sand filters is explained by Flentje[n1], Hulbert advocates the use of a definite degree of **sand expansion** during washing, rather than any set rate[139]. He would prefer to use a velocity such that the sand during maximum wash is lifted until the volume occupied is about 55 to 60% greater than that which it occupied during filtration. Armstrong's experiments point to the use of **larger grained sands**[30]. Baldwin-Wiseman would substitute for the customary term "effective size" used to describe the sand, a more complex term based upon, (1) the aggregate surface per unit volume, (2) the percentage porosity, (3) the retentiveness for water of the surface of the grains as expressed in terms of the "ideal film"[66]. At **Cincinnati** it was found that the sand in the filters had increased from an effective size of 0.34 mm. to 0.51 mm. It contained 54% of acid-soluble incrustation. Twelve inches of freshly screened Ohio river sand with an effective size of 0.37 mm. and a uniformity coefficient of 1.46 was placed over 16 inches of the old sand.

Articles of Special Interest:

Sand trap prevents deposit of fine sand from well in zeolite water softener, Holmes [117].

Treatment of water at **Appleton, Wisc.,** Hall[104].

Disinfection of Contaminated Wells with Chlorinated Lime—instructions[108].

Chlorine **sterilization of new mains** at Milwaukee, Thomas[83].

Wanaque reservoir water treated with lime and chlorine, Griffin[164].

Good results with **water softeners** on Atlantic Coast Line Railroad, Anderson[97].

M.K.T. Railroad speeds up trains by adding auxiliary tender in form of **water car,** thus avoiding stops and also securing good water[115].

Cedar Rapids, Iowa, softens its municipal supply, Bates[99].

Management

The relations between the water company or water department and the public served are of the utmost importance. Richards, of the Newcastle, Pa., Water Company, explains how he has met some of his local problems[168] and Dohe, of Tahlequah, Oklahoma, shows how understanding between the water department and the citizens of a small city can be established to the advantage of all concerned[144]. In connection with the work of Committee No. 9, of the Water Works Practice Committee of the American Water Works Association, Howard S. Morse has proposed a rating scale by means of which the **public relations** of the water works may be evaluated[153].

Kunigk, of **Tacoma,** has endeavored to plan far ahead in order that the **rates** charged by the city for water supply may carry extensions and replacements adequately and yet place the rates for water low

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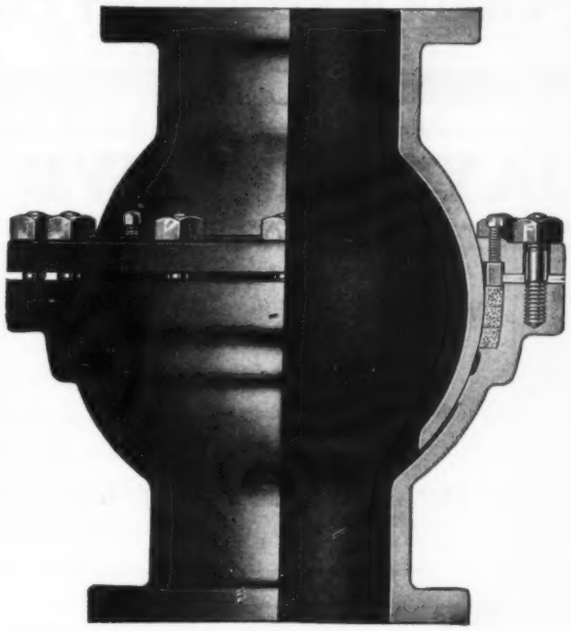

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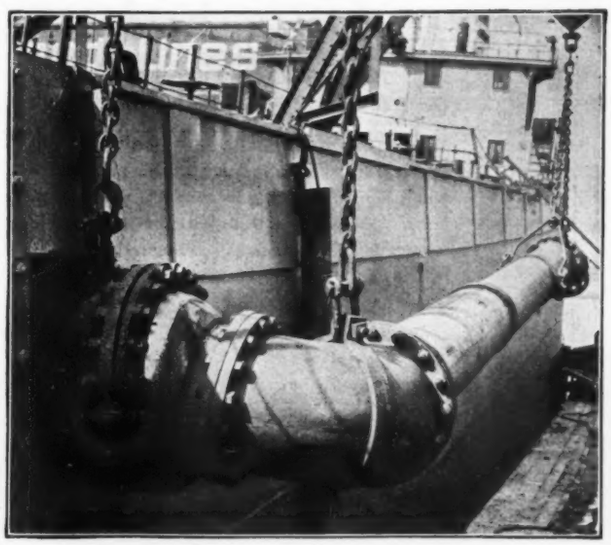

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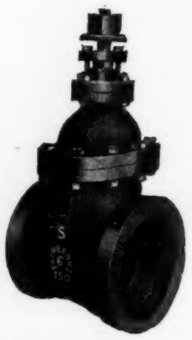

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enough to attract large industrial users of water[94, 146]. Kennedy[141] has endeavored to calculate the water rates of the twenty-five largest cities in Michigan to a uniform rate structure basis following the recommended 4-step basis of the American Water Works Association. Naturally he found great variation in the rates. Costs vary enormously, even in the same city. Between 1908 and 1929, for example, the cost of filtering a million gallons of water at **Cincinnati**[n167] varied from $3.38 to $8.08. When **out-of-town customers** are furnished water[169] they are charged 20% more than the city consumers at Hagerstown, Maryland. In some localities the difference in charges is even more, on the assumption that the city has invested its money in the plant and that the citizens are entitled to be supplied at less profit than those who have not contributed to the local taxes. The sale of the water may be quite profitable where a sufficient excess is available.

Water consumption in Canadian cities has mounted during the recent hot weather. Montreal has had a normal annual increase in pumpage of about 3 mgd. There was about 27,000,000 gallons difference in pumpage between that of July 17th and that of hot July 28th[40]. Calgary's pumpage reached 20 mgd in the summer of 1931. This is equivalent to 230 gallons per capita[n31].

Articles of Special Interest:

New Brunswick, N. J., has a new water pumping station that is expected to pay for itself in reduced pumping costs within three years, Cronk[6].

Minneapolis' water system is to be studied by a committee of three local consulting engineers to determine needs, rates and other matters[n65].

Nicholas S. Hill, Jr., is to study the water rates of **Shanghai**[n156]. The American City continues its symposium on **water rates**[9].

Questionnaires show that most cities answering prefer to **collect water bills** quarterly for domestic users and monthly for industrial customers[166].

Legal status of **water funds,** Parker [154].

When **water works extensions and improvements** are legal, Parker [136]. **Franchise taxes** lack uniformity of charge and basis, Tobin[138].

Springfield, sued by Cobble Mountain Dam contractors[n148].

Survey of water works superintendents' salaries shows 11% receive more than the $4875 set as the minimum on which a family of four can live in a "professional style," Sette,[n7].

Sanitation

An unusual trouble with **oil refinery waste** was noted at Chester, Pa.,[n158] for while large amounts of chlorine added to the water seemed helpful, an attempt to destroy any excess by means of sulfur dioxide produced a **garlic-like taste.** This was probably due to the formation of a sulfur compound of some sort. Hetzel[72] discusses **chlorophenol** tastes in drinking water.

Laboratory

Tonney and Noble[102] have improved the **cyanide citrate pour plate** method for estimating the numbers of colon-aerogenes group organisms and differentiating between the two basic types. Poe[105] reviews the literature of differential tests for the **colon-aerogenes group** of bacteria and recommends the sodium citrate test of Koser and eosine methylene blue agar.

Spaulding[11] attempts to provide a method for the **quantitative determination of odor** in waters by es-

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tablishing the point at which odor can first be detected as the water is diluted with deodorized distilled water. The value is expressed as a threshold number.

Nichols and Foote[79] find that too little alkalinity results in incomplete release of ammonia in **ammonia nitrogen** determinations, while an excess causes too much hydrolysis of nitrogenous compounds. They prefer to use a buffer mixture which will maintain the pH of the distillation mixture at 7.4.

Phenol determinations in water are becoming more and more necessary in order to know the tastes which will be developed in waters polluted by gashouse wastes and other phenol-containing liquors. It is also desirable to measure the amount of phenols, or compounds related to carbolic acid in the wastes. Methods for the minute quantities found in waters have been quite well developed, but for concentrations between 1 and 75 parts per million the procedures have been very unsatisfactory. Shaw[77] has worked out a procedure whereby the phenol content of wastes in this range may be determined by the bromine method ordinarily restricted to higher concentrations.

The use of **wide-range indicators** for determining pH values of water and sewage is attractive on account of its simplicity. McCrumb[75] warns against the use of these indicators unless the pH of the indicator solution is very close to that of the water or sewage. The water or sewage is apt to be so lightly buffered that the influence of the solution used may destroy the accuracy of the test.

The technique of **stream pollution investigations** is discussed by De Laporte[35]. Much of the work naturally concerns the **dissolved oxygen** content and the determination of biochemical oxygen demand. In order to provide correction factors for the error introduced by the addition of the chemical reagents where bottles of different sizes are used, Wright and Theriault[122] have devised a **nomogram chart** to simplify the calculation. Heckman[71] considers whether oxygen content of water has anything to do with the scale formation in boilers. Rummel[80] describes the estimation of **solids in steam** by a conductivity method. A small piece of apparatus resembling a valve enables study of metals and liquids to be made in boilers to determine **corrosion effects** with ease and precision. It allows small metal cubes with polished surfaces, or small coils of wire on porcelain spools to be inserted and removed readily. Scribner[76] describes the determination of water in **liquid sulfur dioxide.** Most of the material now supplied contains about 5 parts per million of water and guaranties are usually fixed at not more than 50 ppm.

Hydrographic instruments and means of improving their accuracy are discussed by Hall[46]. Rain gauges, recording or indicating level measuring instruments dependent on floats, and current meters are considered.

Articles of Special Interest:

Rapid methods of determination of **potassium,** Clarke and Davidson [81] and Miller[43].

Determination of **manganese** by potassium periodate, Miller[44].

Glass color standards for use in the determination of **phosphorus** in waters by Denigés method, Chapman[78].

Pool and Swimming Beaches

Articles of General Interest:

Zimmerman[13] surveys the field of pool sanitation and **operation.**

Bathing load and capacity **formulae,** Becker[15].

Cleaning **tile** pool bottoms, Ellsworth[23].

Liability for failure to provide **life guard,** Sweet[19].

Liability of pool operator for **jewelry loss,** Sweet[25].

The de luxe pool of the **St. George Hotel, Brooklyn,** [20], [21], [22].

Description of pools at **Glasgow**[14], **Elizabeth, N. J.**[114], **Newburgh, N. Y.**[18], **Redcar** baths (England) n[58], and **Touquet-Paris-Plage** (France)[70].

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n Note or Short Article.

American City, Vol. 45, No. 3 (Sept., 1931.)
n1. Washing Rapid Sand Filters, Martin E. Flentje, p. 7.
n2. Improvements to New Jersey Water System, Nicholas S. Hill, Jr., p. 7.
n3. Cast Iron Pipe for Natural Hot Water Distribution, T. B. Jackson, p. 7.
4. "Out with Sulfuretted Hydrogen in Drinking Water," says Beverley Hills, Arthur Taylor, pp. 77-79.
n5. Financing Water Works in the Old Days, Anon., pp. 103-104.
6. A Pumping Station Pays for Itself, Ellis Irving Cronk, pp. 105-106.
n7. How Adequate are Municipal Engineers' Salaries? F. J. Sette, p. 107.
8. Achievements in the Battle Against Typhoid, Anon., p. 108.
9. Water Rates and Regulations, Part V., Anon., pp. 129, 131, 133, 135, 137.

American Journal of Public Health, Vol. 21, No. 9 (Sept., 1931.)
10. A Water-Borne Typhoid Fever Outbreak, Frederick W. Sears, pp. 1019-1023.
11. Quantitative Determination of Odor in Water, Charles H. Spalding, pp. 1038-1039.
12. Sanitary Engineering in a County Health Department, R. E. Cook, pp. 1044-1051.

Beach and Pool, Vol. 5, No. 7 (July, 1931.)
13. The Swimming Pool and its Operation (Part I), pp. 287-291, 310, and 317; also Part II, No. 8, 341-343, and 358 (Aug., 1931), and Part III, No. 9, pp. 392-393, 412-413 and 414 (Sept., 1931.)
14. Glasgow's 33 Swimming Pools, Clyde Irvine, pp. 294-295, 314-315.
15. Some Features of Swimming Pool Design, W. A. Becker, pp. 296 and 298.

Beach and Pool, Vol. 5, No. 8 (Aug., 1931.)
16. Sanitation First—Business Will Follow, Anon., pp. 344-346 and 364.
17. Sanitary Control of Rhode Island Swimming Places, Chas. L. Pool, pp. 347-348 and 350.
18. Newburgh Becomes a Swimming Pool Owner, J. Renwick Thompson, pp. 352 and 373.
19. Does Failure to Employ Life Guard Make Swim Resort Operator Liable? A. L. H. Sweet, pp. 356, 365, 373.

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20. How $1,264,000 was Spent on the St. George Hotel Pool, Anon., pp. 383-386.
21. Some Special Features in the Planning of the St. George Pool, Manfred Messer, pp. 387-388, and 412.
22. Purification and Other St. George Pool Features, Anon., pp. 390 and 414.
23. Keeping Pool Tile Clean, H. M. Ellsworth, pp. 384 and 409.
24. Ultra Violet Ray Pool Water Sterilization, E. Berndt, pp. 398, 400 and 417.
25. What is the Liability of Swim Resort Operators in Jewelry Loss Claim? A. L. Sweet, pp. 404-405, 415-416.

Bulletin of the Associated State Engineering Societies, Vol. 6, No. 3 (July, 1931) (23rd Annual Meeting Engineering Society of Wisconsin.)
26. The Use of Elevated Storage in Water Works Systems, E. F. Taughe, pp. 83-88.

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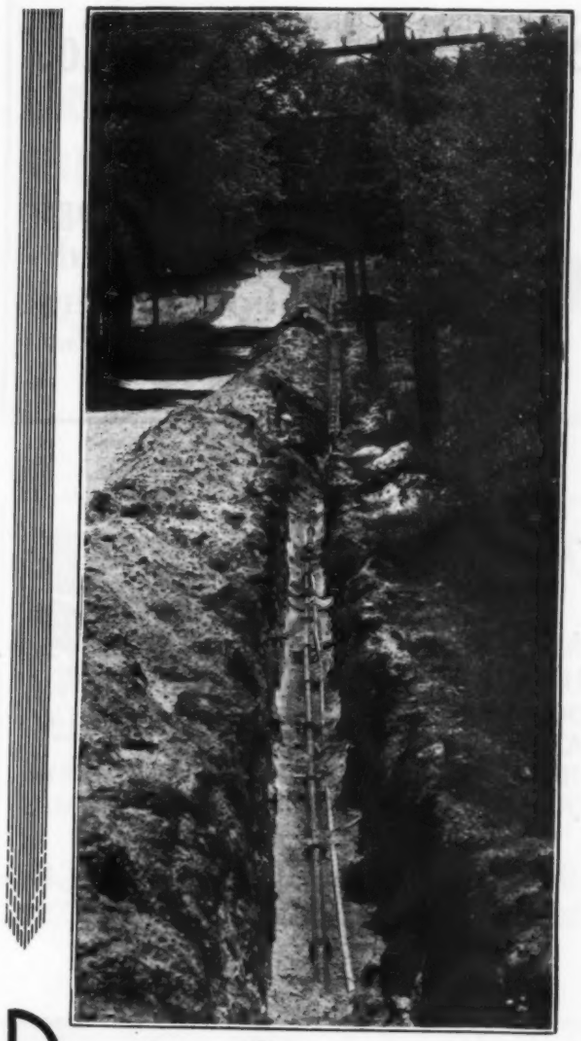
The Filter Moth Fly and the Flame

(Continued from page 29)

flaming at Schenectady is 20 cents for materials, or 2.8 cents per thousand square feet of surface. With less area to cover, the cost will undoubtedly increase somewhat as a result of the necessity of heating up the torch for the shorter run.

Similar quantity tests have been carried out on the spraying methods used at the sewage-works. This operation has usually required approximately seven gallons of spray to cover the 7200 square feet of the galleries. The amount of material has thus been decreased to one-third by the flaming methods. If



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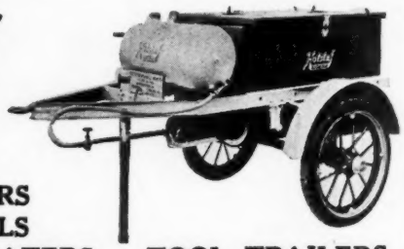
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only cheap oils were used in spraying, the cost of spray control would be three times that of flaming. Ordinarily, spraying has been carried out with liquids made up of cheap oil bases and such added toxic materials as crude carbolic acid, ortho-dichlorbenzene or pyrethrum. With these insecticides added, the cost comparison becomes more favorable for the flaming methods described. The usual costs have varied from one-fifth to one-seventh that taken for spraying.

The torch assembly used in the Schenectady tests was purchased at a moderate price from a local concern, The Mohawk Asphalt Heater Co., which manufactures the equipment for asphalt heating. An official of the manufacturer cooperated in the preliminary adjustments of the equipment to suit the new use.

Other Uses For The Torch: The same equipment used for fly flaming has found many other uses at the treatment works and is recommended for still others. The fly control was made more effective by the use of the flame to singe flies out of the roughnesses of stucco walls and off the eaves of a series of painted frame gallery entrance enclosures. The rapid sweep of the hot flame had no effect on the masonry and never scorched the paint.

The flame was used to burn off the gelatinous half-circles that the end nozzles produce on the gallery walls. These wetted areas breed flies and mosquitoes. The torch has been used to ignite the heavy grease film that develops on the nozzle domes and spindles and interferes with sewage distribution on the filters. The flame has also been directed on the heavy film on some of the surface stone of the filters and has succeeded in burning off the mat without spalling the stone. It is, nevertheless, possible to shatter the stone with the intense heat. It has been found that the application of the flame to the surface stone destroys all the larvae and pupae of Psychoda present on the under side of the media.

The torch is useful in singeing the stray flies out from around the base of heavy grass and weed growths and it was for this purpose that the torch was purchased. The flame has been used to burn weed growths that spring up in the plant roadways. The work is more rapid than the usual grubbing method. Many other uses suggest themselves. The torch makes a heating unit for blacksmith work of all kinds encountered at a sewage-works. It should be helpful in thawing out frozen pipes, thawing the ground for mid-winter excavations, drying sand and gravel, heating concrete and thawing out switches on a sludge bed system during sleety weather. It can be used as a heater in a salamander. The pressure tank can be used separately as the fuel tank for ordinary spraying. The high pressure produces a finely diffused mist and results in a penetrating spray.

Fly Destruction With a Small Hand Torch: While the portable type of torch and pressure tank described has been used for routine auxiliary fly control, sufficient work has been carried out with a small hand torch to indicate that this lighter, cheaper unit should prove highly satisfactory for the small plant where the larger outfit might prove cumbersome in operation and somewhat expensive in initial cost. The unit consists of a 1 1/3-gallon fuel tank with hand pump, oil gauge and pressure gauge, direct connected to a small torch with preheating coils similar to those contained in the large torch. The flame, while much smaller in diameter and length, develops a temperature of over 1500 degrees F. and burns approximately ¾ gallon of fuel an hour. It is easily han-

dled by a worker walking along the filter walls. The speed of singeing is slower than with the large torch but the fuel cost per thousand square feet is practically the same. Its effectiveness for fly singeing has been proven by repeated tests.

Conclusion

It is the story of the moth and the flame, with modern improvements. The flame of old waited for the moth to be attracted and have its wings singed. The new torch method seeks out the moth fly. The Psychoda never have a chance. It is ruthless slaughter.

Many a hectic trickling filter operator has mentally consigned his own personal mess of flies to a warmer climate. This gentleman has just gone through a trying summer when the temperature and the humidity vied with each other in producing ideal conditions for Psychoda propagation. He should welcome the opportunity of bringing the conditions of the well-known inferno to his fly colony. Satan himself could gloat no more over his flickering flames and his sulphurous fumes than will the operator over the smell of singeing hair that follows in the wake of the devastating torch.

Intercepting Chamber for Combined Sewers

(Continued from page 19)

by the storm water, and the duration of storm flows being relatively short, the effect of these small quantities of sewage in the river is negligible.) At the same time, the small gate is closed to within an inch or so of the invert, allowing just enough water to pass to maintain a flow approximately equal to the normal dry-weather flow. This provision is made to prevent too rapid a change in the flow conditions at the pumping station and treatment plant. When, with the subsiding of the storm, the water level drops to the usual dry-weather flow, the action of the float on the four-way valve is reversed and causes the large gate to close and the small one to open, affording a resumption of the normal functioning of the sanitary sewer.

To provide against flooding in the event of failure of the storm gate to open, sufficient room is left between the top of the storm gate and the roof of the sewer to allow the storm water to pass.

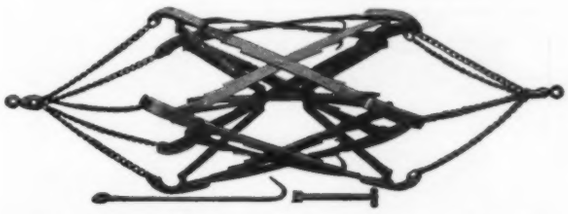
It has been possible, in some installations, to omit the small hydraulic cylinder operating the intercepting gate. Instead, the operation of this gate is accomplished mechanically by a system of levers from the storm gate.

The chamber is constructed of reinforced concrete; the inlet side is flared to change from the shape of the existing sewer to a flat bottom. The interior is lined with vitrified liner plates. The roof has three manholes, giving access to the float chamber, the cylinder chamber and the storm gate, respectively.

A large number of these chambers were required, the design of each varying with the size of sewer, available cover, distance from river or treatment plant, etc.

In future design and construction of sewerage systems, the treatment of the sewage will become a dominant factor and often exclude the combined sewer from consideration; but the possibilities of its continued use, where it already exists, are greatly enhanced by the practical and economic aspects of this device.

EXPANDING ROOT CUTTER AND SEWER CLEANER



The Expanding Root Cutter and Sewer Cleaner works on a lazy tong principle. It can be EXPANDED or CONTRACTED from 5½ to 30 inches, to fit any sewer within these limits. It is possible to make the adjustment in thirty seconds.

It is fitted with five sets of double knives, constructed of spring steel, making some 40 feet of cutting edge, and when drawn back and forth between two manholes by a windlass stationed at each end, the roots are severed by the knives which operate in V-shape formation, like the blades of a pair of scissors.

COMPLETE SEWER CLEANING EQUIPMENT

Let us know your wants. Write for catalog.

EXPANDING SEWER MACHINE CO.

NAPPANEE, INDIANA

In Modern Sewage Plants Separate-Sludge-Digesters are used

SATISFACTORY OPERATION, HOWEVER, DEPENDS UPON

CONSTANT SCUM SUBMERGENCE
in the digestion tanks
also upon

CONSTANT GAS PRESSURE
at the burners

DOWNES FLOATING COVERS
provide these essential
operating features, because they float

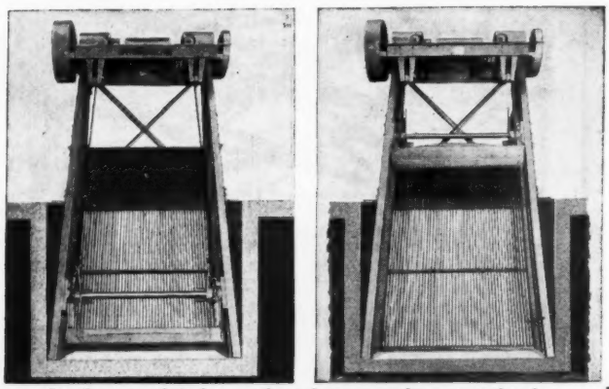
We design these Covers to provide the needed pressure.

Write us for full particulars.

Pacific Flush-Tank Company

136 Liberty St., New York, N. Y.
4241 Ravenswood Ave., Chicago, Illinois

Applying STRAIGHTLINE Principles
To Sewage Screens, Aerators and Collectors



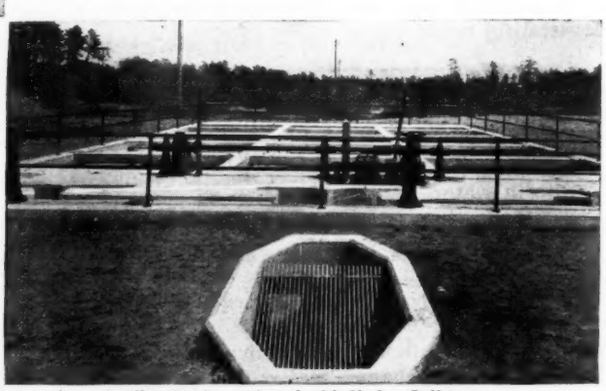
Bar Screen at left shows rake at bottom ready to start cleaning screen bars, and right shows rake at top ready to return.

STRAIGHTLINE
(Trade Mark Registered)
BAR SCREEN
(Patents Pending)

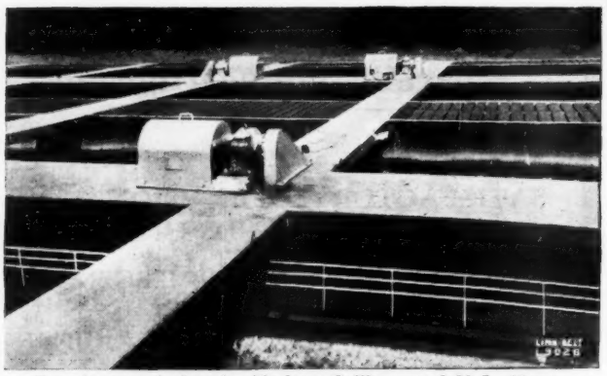
Strength and reliability are the outstanding features of this screen. The clear opening of the bars may be as small as ½". Width of screens varies from 3'0" to 11'0".

STRAIGHTLINE
SLUDGE COLLECTOR
(Patents Allowed and Pending)

Efficiency, simplicity of operation, and their long service records, are reasons for the large number of plants now being equipped with Link-Belt STRAIGHTLINE Sludge Collectors.



Settling Tanks equipped with Sludge Collectors at the Lakewood Sewage Treatment Plant.



Four Aerators in Aeration Tanks at Collingswood, N. J. (Remington, Vosbury & Goff, Consulting Engineers).

STRAIGHTLINE
AERATOR
(Patented)

These STRAIGHTLINE Aerators treat the sewage of a population of 13,000 here at Collingswood, N. J. The B.O.D. of the influent averages 500 P.P.M., of the effluent 16 P.P.M.

Turn to Link-Belt for Sewage Treatment Plant Equipment — Collectors — Fine Screens—Bar Screens—Aerators—Grit Chambers, etc. Send for Book No. 642.

LINK-BELT COMPANY 4324

Leading Manufacturers of
Equipment for Handling Materials Mechanically and for the Positive Transmission of Power
PHILADELPHIA, 2045 West Hunting Park Avenue CHICAGO, 300 West Pershing Road
SAN FRANCISCO, 400 Paul Avenue TORONTO, Eastern Ave., & Leslie St. Offices in Principal Cities

LINK-BELT

SCREENS ▾ COLLECTORS ▾ AERATORS ▾ GRIT CHAMBERS

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 75

ENGINEERING PUBLICATIONS

Bridge and Highway Data.—Two volumes of value to bridge engineers and highway engineers have just been published by the American Association of State Highway Officials. One volume, "Tentative Standard Specifications for Highway Materials and Methods of Sampling and Testing," contains a comprehensive summary of all specifications in this field that have been adopted by the Association. The other volume, "Specifications for Highway Bridges and Incidental Structures," contains in complete form the standards adopted by the Association and it covers everything pertaining to concrete, steel or timber bridges.

Many methods of sampling and testing materials are published in the highway volume for the first time. Seventy-four methods of sampling and testing materials are presented and, since many of the methods are similar to the standards of the A. S. T. M., reference to the A. S. T. M. standard is given in notes under the titles. Changes from A. S. T. M. standards are indicated by footnotes following descriptions of the methods. The section dealing with testing materials is well illustrated.

Although the volume dealing with bridges was primarily compiled to meet the requirements of state highway bridge engineers, it is valuable as an authentic reference and guide to all engineers engaged in bridge design. Those features dealing with steel were approved jointly with the bridge engineers of the American Railway Association. The books may be obtained for a nominal sum from the American Association of State Highway Officials at Washington, D. C.

Elevating and Conveying Machinery.—One of the most complete catalogs ever published on standard and special elevating and conveying machinery has recently been published by the Fairfield Engineering Company, Marion, Ohio, specialists in the design and construction of this type of equipment for practically every purpose. Throughout its hundred pages it contains just the information needed by buyers of elevating and conveying machinery and is for the purpose of aiding them in suitable selection for their particular needs. A few of the subjects covered extensively are: The Selection of a Belt Conveyor; Storage Silo Systems; Power Plant Equipment; The Installation of Bucket Elevators; V Bucket Conveyors; Flight Conveyors; Apron Conveyors; Package Conveyors; Spiral Conveyors; Skip Hoist Installation; Railroad Equipment; the use of Coal Handling Equipment and many other subjects are carried. Within its attractive covers are many blueprint installation diagrams. It is profusely illustrated with actual installations that might apply to numerous prospective installations. A copy of this catalog will be sent gratis to anyone interested in this type of equipment.

New Fence Booklet.—A new fence booklet which contains many illustrations of typical fence installations, has recently been published by the Page Fence Association. It also contains various style sheets of Chain Link and Wrought Iron Picket Fences, and includes logical reasons why a well-fenced property is a paying proposition.

This booklet is titled "The Border Patrol" and should be in the files of every person interested in fence. It may be had by addressing the Page Steel & Wire Company, Bridgeport, Conn.

Sling Chains.—A new book which gives complete information on all standard types of Sling Chains has just been announced by American Chain Company, Inc., Bridgeport, Conn.

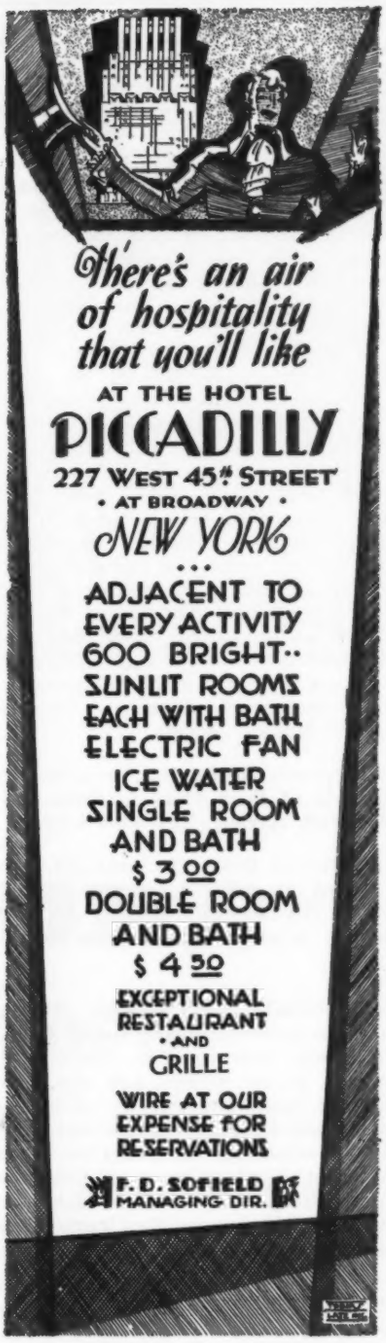
In addition to specification tables which are printed in large readable type, it gives definitions, cautions and instructions governing the purchase and use of chain. On the back cover, for handy reference, is printed chart which shows the safe working loads of iron sling chains when used at various angles. A copy of the book may be obtained without charge by addressing American Chain Company, Inc., Bridgeport, Conn.

Armco Cribbing.—A booklet describing a new metal cribbing (developed recently by The American Rolling Mill Company) of simple, yet effective design is being offered by the Armco Culvert Mfrs. Association, Middletown, Ohio. The new cribbing is adaptable to use for railroads and highway retaining walls, bridge wing walls and river and harbor bank protection work.

Drawings and photographs show how the cribbing is installed and how both the open and closed-face types look when in place. A copy will be sent on request.

Floodlighting. A discussion of modern principles and practice in floodlighting is presented by the Westinghouse Lamp Company and the Westinghouse Electric and Manufacturing Company in a new joint publication entitled, Skylines Beyond the Twilight Zone, identified by the companies as A-1208 and assigned A.I.A. No. 31-F-24. In this 23-page publication, D. W. Atwater, Commercial Engineering Department, Westinghouse Lamp Company, describes the advantages of floodlighting and gives recommendations useful in making floodlighting installations. Included are several photographs showing floodlighted office buildings, monuments, towers, industrial plants, residences, athletic fields, filling stations, and other structures. Photographs and descriptions of Westinghouse floodlighting equipment are also included.

Glass Enclosures.—The American-Monninger Greenhouse Mfg. Corp., 1947 Flushing Ave., Brooklyn, N. Y., has issued a bulletin describing their glass enclosures for sludge drying beds. Many details of construction are illustrated and specifications for glass enclosures are outlined. This will be sent on request to engineers and officials.



NEWS OF THE MANUFACTURERS

The Nye Odorless Incinerator Corporation, with headquarters at Macon, Georgia, and of which A. C. Felton, Jr., is President and in charge, announces that there is no connection between that Corporation and any other incinerator company. There has been no merger or consolidation or coalition or any other connection whatsoever discussed or considered with the present management of this Corporation.

Nye Odorless Incinerator Corporation, under a different management, had its headquarters at Albany, Georgia, from September, 1929, until May, 1931, when the voting power of the Corporation, on account of defaults in the charter provisions, passed to the holders of the Prior Preferred Stock and the business was turned back to the Prior Preferred Stockholders by the courts.

Those interested in Nye Odorless incinerators should address the Corporation at Macon, Georgia.

Colprovia Roads, Inc., announce the removal of their offices to Room 657, 230 Park Avenue, New York City.

Littleford Bros., Cincinnati, O., have received an order from the Pennsylvania Highway Department for 110 asphalt heating kettles of the 84-WS type.

The Chain Belt Company, Milwaukee, has appointed two new distributors to handle their complete line of Rex mixers, pavers, pumps, saw rigs, plaster and mortar mixers, central mixing plants and other construction equipment. In Vermont they have appointed the Vermont Road Equipment Company, Montpelier, Vermont, and in Idaho they selected Northwest Machinery Company located at 710 Front Street, Boise.

The Ludlow Valve Mfg. Co., of Troy, New York, will manufacture in Canada as The Canadian Ludlow Valve Mfg. Co., Limited. Offices are located at 930 Wellington Street, Montreal, Que., and factories at Three Rivers, Que., St. Thomas, Ont., and Fort William, Ont.

The Gardner-Denver Company has just completed arrangements with the Hazard-Gould Company of San Diego, Cal., whereby the Hazard-Gould Company has the exclusive agency in the San Diego territory for all Gardner-Denver products, with the exception of the oil field steam and power pumps. Included in the products distributed by the Hazard-Gould Company are Gardner-Denver Rock Drills and Gardner-Denver Portable Compressors.

E. O. Williams, associated for the past sixteen years with the transmission and industrial chain trade in various sales capacities, and formerly manager of the Howe Chain Company, has been placed in charge of the Philadelphia office of The Union Chain & Mfg. Co., Bourse Building, Philadelphia.

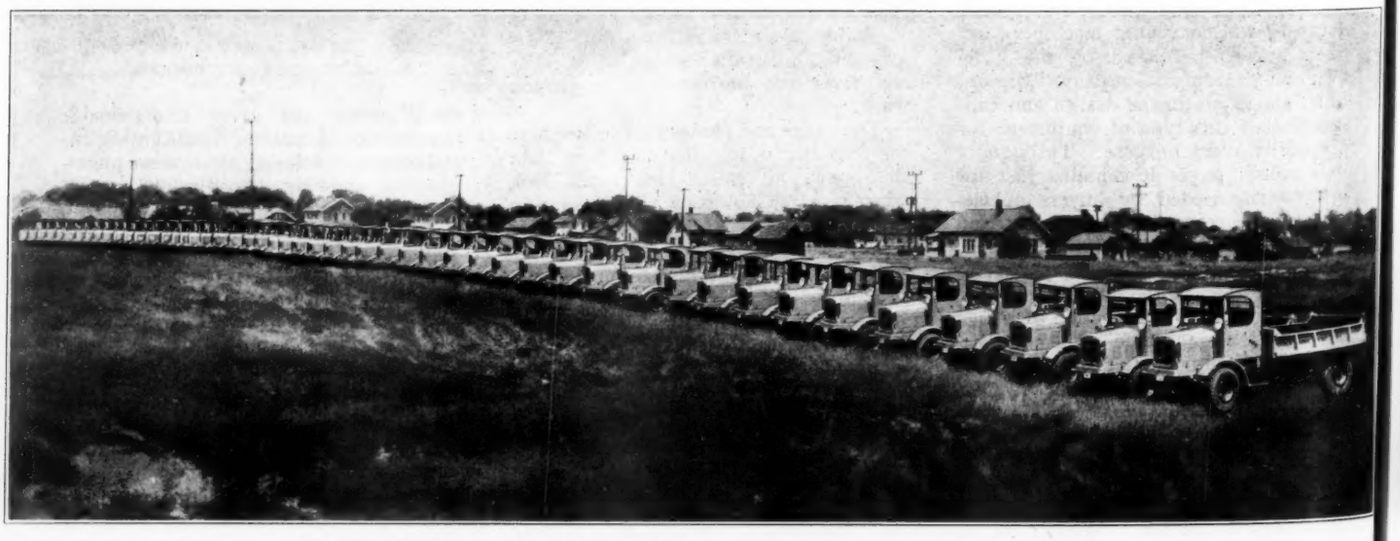
The Texas Contractors Supply Company of Waco, Texas, will represent the Gardner-Denver Company on all rock drill products and portable compressors. Both of the above companies are very well known in contracting, engineering and oil field circles.

In addition to established branch offices in New York, Pittsburgh, Detroit, Chicago and Los Angeles, the Manganese Steel Forge Company, Richmond St. and Castor Ave., Philadelphia, Pa., manufacturers of "Rol-Man" rolled and forged manganese-steel products, recently has appointed the following representatives: J. G. Logan, P. O. Box 506, Knoxville, Tenn., serving the states of Tennessee, North Carolina, South Carolina and Georgia; S. L. Morrow Engineering Co., Brown-Marx Bldg., Birmingham, Ala., serving the state of Alabama, Northern Mississippi and Western Florida; C. T. Patterson Co., Inc., 801 Tchoupitoulas St., New Orleans, La., serving the state of Louisiana and Southern Mississippi, and C. H. Collier, 301 N. Market St., Dallas, Texas, serving the state of Texas.

The Ohio Colprovia Company, with offices located at No. 406 Marion building, Cleveland, Ohio, has recently acquired the license to manufacture and distribute Colprovia for the entire State of Ohio, and has awarded a contract for the erection of their first plant to the J. D. Farasey Mfg. Co. It will be located at the Wagner Quarry Co's Soldier's Home Quarry No. 1, at Sandusky, Ohio, and will have a capacity of approximately seven hundred and fifty tons daily, shipping their product in open cars to any point in Ohio.

The Colprovia process is a completely cold process for manufacturing, shipping and laying an asphaltic pavement, which is manufactured in five different types, such as—Sheet asphalt; Binder course; Asphaltic concrete, fine aggregate type; Asphaltic concrete, coarse aggregate type; and Asphalt concrete base, commonly called Black Base.

The State of New York has just purchased for use of the State Division of Highways a large additional fleet of Four Wheel Drive Trucks. The purchase involves fifty vehicles in various body sizes and is said to represent the largest single purchase of like equipment which the State has effected. The new fleet will be used in connection with maintenance work and the units will be distributed among the different districts of the Department.



The State of New York Division of Highways recently purchased 50 F. W. D. Trucks

stamina

in WILLIAMSPORT

TELFAX TAPE MARKED FACTORY CERTIFIED WIRE ROPE

It's a very simple matter to buy wire rope in the hopes that it will give the service you expect. . . . This does not require keen business ability. You know this.

But it does require unusual ability to look through the maze of claims and counter claims and select the rope for your particular job.

Anyone can claim quality, strength, stamina and special advantages and you have to pay the expense of finding out about it.

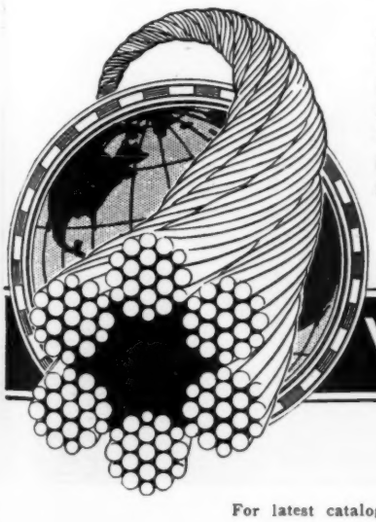
Let us make this clear to you. We make wire rope . . . nothing else, and every man in the works is a specialist in wire rope manufacture with the keenest interest in making Wire Rope as good as it can be made.

To this end we draw all our own wire, in fact, we control the product from the ore to the finished product.

Then we weave into it a "Telfax" Tape upon which the grade and strength of wire in the rope is clearly marked in plain English.

A very valuable protection to the user. No substitution or mistakes can be made between us and you without instant detection.

All this is worth to you more than the rope costs. It will pay you to investigate the superior merits of Williamsport on your job.



WILLIAMSPORT WIRE ROPE CO.

Main Office and Works:
WILLIAMSPORT, PA.

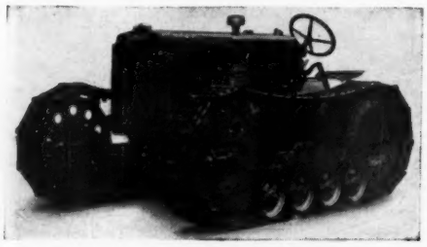
General Sales Offices:
122 So. Michigan Ave., Chicago

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 75

New Equipment for Construction

Heavy Duty Crawlers for Case Tractor

A new heavy-duty Trackson Crawler, known as Model GC, is now available for the Case Industrial Tractor. This combination is suited not only to drawbar work, but to equipment operation as well. Its design provides for the actual in-building of either front, side, or rear-end equipment.



Trackson Heavy Duty Crawlers

The Trackson Co., Milwaukee, Wis., or the J. I. Case Co., Racine, Wis., will gladly furnish further details.

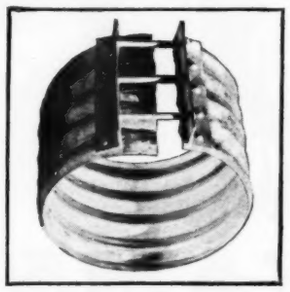
Flexible Joints for All Purposes

The Barco Manufacturing Co., Winnemac Ave., Chicago, Ill., manufacture flexible joints which have a wide range of usefulness. They are made in sizes up to 48-inch for water lines and provide great flexibility and utility for intakes and other places requiring flexible joints as on river or lake bottoms. There are many places around sewage disposal plants where flexible joints are required, or where it is desirable to provide for expansion and contraction.

The accompanying illustration shows a Barco joint for flange pipes, which is made in sizes from 4 to 48 inches. Other types are made in sizes from ¼-inch up.

Barber-Greene New Vibrating Screen for Bucket Loader

A new three-product vibrating screen for use with their Model 62 Heavy Duty Self-Feeding Bucket Loader has just been introduced by the Barber-Greene Company of Aurora, Illinois. The screen is designed for operation in gravel pits, in coke plants, on road jobs, or in any place where bulk material must be classified by size. It will take gravel direct from the bank in a pit and load it out as oversize, gravel, and plaster sand; or it will take coke as it comes from the oven and separate it into furnace coke and nut coke, at the same time cleaning out the breeze. When such a fine classification of gravel or coke is not desired, the screen may be made into a two-product unit by removing one screen cloth.



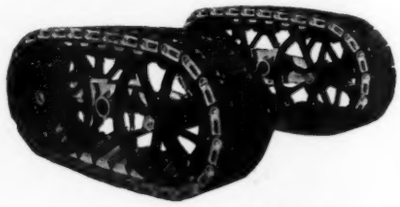
Armco Connecting Section

Armco Connecting Bands

Armco Culvert Mfrs. Assn., Middletown, Ohio, manufactures a scientifically designed band for connecting sections of corrugated pipe. It is made for all sizes, in two types. One is 7 inches wide for small and medium size pipe, and the other 12 inches wide for moderate and large pipe. It can be placed and tightened by one man.

La Plant-Choate "Roadlayer" Tracks

La Plant-Choate Mfg. Co., Cedar Rapids, Ia., manufacture "Roadlayer" tracks which are adapted for any hauling equipment or hauling work. They are strong and durable and pull easily over the roughest ground. The manufacturers have just issued a new catalog, giving full data, which will be sent on request.

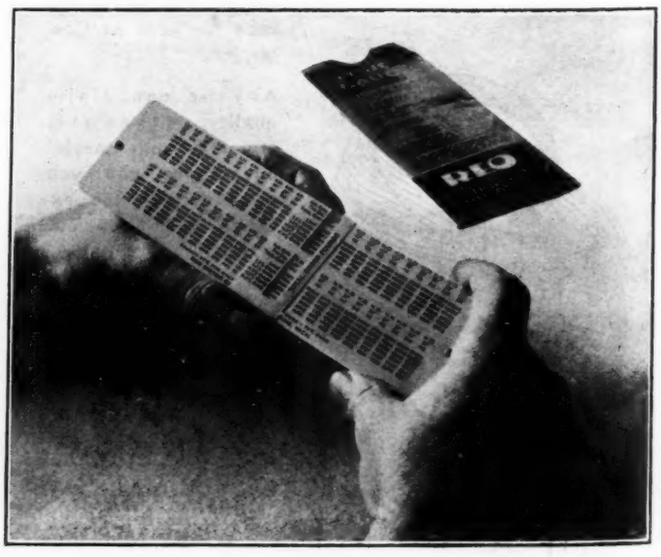


The Roadlayer Tracks

A Motor Truck Slide Rule

A valuable celluloid slide rule which tells accurately the number of gross pounds (truck and load) that the Reo Gold Crown engine is capable of pulling under varying conditions, noting tire sizes and rear axle ratios required, has been made available to all Reo Speed Wagon owners and prospects by the Reo Motor Car Company, and is being received by truck operators as an aid in planning loads for various routes.

It is easy to understand the value of this slide rule to operators who are confronted with constantly changing haulage conditions. The value of being able to easily calculate the peak load to be carried under different road conditions and the exact gear ratio and tire sizes necessary to exactly meet the haulage needs of every probable route on which the trucks will be operated is very great.



Above, the Barber Greene Vibrating screen and loader. Right, the new Reo Slide rule.

TO HELP YOU IN YOUR WORK, ANY OF THIS

INDUSTRIAL LITERATURE

WILL BE SENT **FREE** UPON REQUEST

IT is a good practice to check this list regularly because descriptions of new bulletins are always being added.

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illutsrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction.

9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schnectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Clamshell Buckets

27. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Clamshell Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request.

28. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna. publishes a 32-page catalog descriptive of all types of Blaw-Knox Dreadnaught Clamshell Buckets, No. 1234, illustrating various construction features and giving a complete list of types and sizes. A complete catalog on Blaw-Knox Dragline Buckets, No. 1247, will also be sent upon request.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Jaeger Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Crushers

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg Co., Galion, Ohio.

Culverts—Large Diameter

59. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems, will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

60. Ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service, are listed in the new catalog, "Armco Large Diameter Corrugated Pipe," as the advantages following the use of larger diameter culverts in meeting small bridge requirements. Catalog No. 8 will be sent free on request. Address Armco Culvert Mfrs. Association, Middletown, Ohio.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks are described and fully illustrated in technical literature published by the Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Finishing Machine

74. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna. publishes Bulletin No. 6, completely descriptive of the Ord Road Finisher and its application to the finishing of all types of concrete and asphalt pavements. This bulletin will be sent upon request.

75. Complete description of Lakewood Finishers, showing use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages published by The Lakewood Engineering Company, Columbus, Ohio.

Graders

76. Elevating Graders. Two publications by the Caterpillar Tractor Co., Peoria, Ill., illustrate the Caterpillar Sixty Grader with and without engine.

Excavating Buckets

80. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Excavating Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request.

Hammers, Self-powered

82. A new bulletin describing and illustrating the use of RODAX, a portable self-powered, gasoline driven hammer, has just been issued by the Rodax Corp., 2199 Lumber St., Chicago, Ill.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company. Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

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PUBLIC WORKS
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Date

Please send me without obligation the following catalogs listed under INDUSTRIAL LITERATURE SECTION:

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(Indicate by Numbers)

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Name — Street Address — City

10-31

Lanterns and Torches

90. Send for interesting catalog in colors of Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

91. An illustrated folder in two colors has just been printed describing the Toledo Torch for illuminating hazards on highway and other construction. Issued by the Toledo Pressed Steel Co., Toledo, Ohio.

92. "Setting a New Standard of Torch Efficiency" is the title of a new folder giving full details concerning specifications of the Cleveland Flaming Torch. Includes illustrations of the special burner. Just issued by the Consolidated Iron-Steel Mfg. Co., 1290 E. 53rd St., Cleveland, Ohio.

Loaders and Unloaders

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

100. Link-Belt Co., Chicago, Ill. General Catalog No. 500, describing the entire line of Link-Belt Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery.

Motor Trucks

106. "Operating Trucks Profitably in Contracting"—A 24 page survey with practical data on efficient truck operation and what to consider in selecting new equipment just published by General Motors Truck Company—Pontiac, Mich.

107. The new "Operating Record for Motor Trucks" just issued by Dodge Brothers Corp., Detroit, Mich., is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations.

108. Four-wheel-drive trucks to increase the range of truck operation and for economy of operation for use in road building and maintenance, described in a series of new folders just issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36 page booklet with 66 illustrations has just been issued by the Barrett Co. giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Power Graders

117. A large wall display piece, No. 3101, printed in three colors and containing a very large illustration of the WARCO Model "E" power grader as well as complete description and working views on center control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

120. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

121. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

122. Building Roads Better, Cheaper and Quicker. A book by the Caterpillar Tractor Co., Peoria, Ill., telling how smooth, well-built roads can be built better, cheaper and quicker. It pictures the machines which do this work, and tells how the machine's economy, dependability and stamina are important.

Road Rollers, Scrapers, Graders, etc.

124. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna. publishes Bulletin No. 1310 descriptive of Blaw-Knox Dirt Moving Equipment including the Blaw-Knox "Ateco" Dirt Mover, the Blaw-Knox Wagon Grader, Scarifiers, Bulldozers and Tamping Rollers. This bulletin contains a complete description of the equipment and valuable cost data on dirt moving. It will be sent upon request.

126. Illustrated catalogs and descriptive material HERCULES, 6-cylinder road roller. Gasoline engine. Sizes 6, 7, 8, 10, 12, and 15 tons. Three speeds forward and backward. The Hercules Company, Marion, Ohio.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8¾ x 11, leatherette cover, numerous action pictures.

129. Caterpillar publications as follows: Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty Planer, the Hi-Way Patrol Grades No. 3, the Ten Motor Patrol, and the Auto Patrol. These cover a wide range of valuable and useful information on road-building machinery. Caterpillar Tractor Co., Peoria, Ill.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and Straight and Leaning Wheel Graders. Galion Iron Works & Mfg. Co., Galion, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

137. Road Machinery. Comparative specifications of the various types of equipment manufactured by the Caterpillar Tractor Co., Peoria, Ill.

Sand and Gravel Washing Plants

138. The Dorrco Sand-Washer is inexpensive to install and operate, and produces a clean, drained sand with a minimum of waste. It will make separation at any point between 20 and 100 mesh. Ask for bulletin No. 4101. The Dorr Co., 247 Park Ave., N. Y.

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K3 just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. The complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heltzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Steel Storage Bins

162. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna. publishes Catalog No. 1302, descriptive of the complete line of Blaw-Knox Contractors Equipment including steel storage bins, measuring equipment for proportioning concrete aggregates, cement and water, ready-mixed concrete plants, trukmixing and agitator bodies. This catalog will be sent upon request.

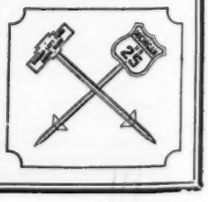
Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" illustrated, is now ready for distribution by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

Sweet's Steel Co.
Williamsport
Penna.

SWEET'S
You can't use stronger, more durable or better weather resisting steel posts for your fence requirements than Sweet's Steel Posts—
STEEL POSTS

Write for Descriptive Folder

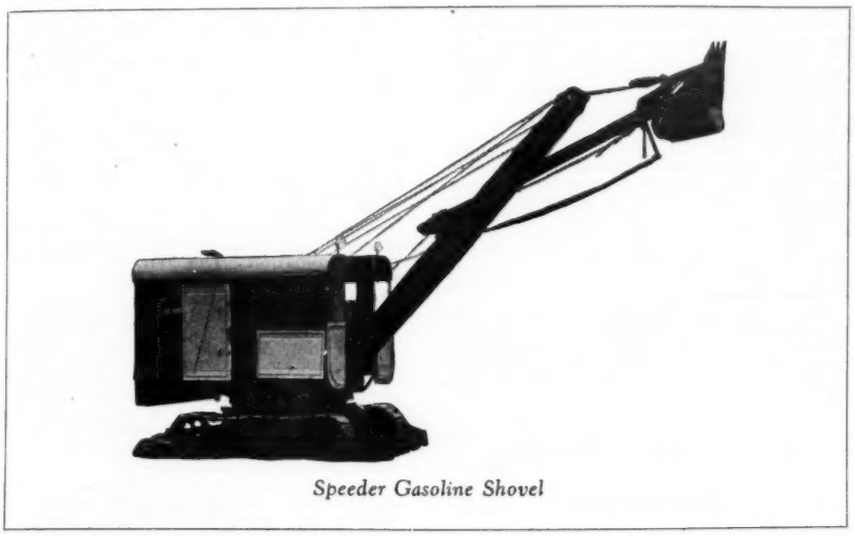


Some Efficient Equipment

An Improved Half-Yard Gasoline Shovel

The Speeder Machinery Corporation, Cedar Rapids, Iowa, have announced an improvement in the crawlers and driving mechanism of the Speeder Model B3 of ½ yard capacity. The new type crawlers and driving mechanism are designed especially to eliminate friction and to expedite the repair and adjustment of the traction shaft while on the job. The crawlers are of the lug driven type, 16 inches in width and are hinged by three eyes. A roller idler now replaces the idler sprocket on the front of the crawlers. All crawler carrier trunnions and return rollers are bronze bushed. The traction shaft is splined and no keys are used. It is supported by four heavy bronze bushed split bearings, and is in three separate shafts, rather than one long shaft, which allows the man on the job to quickly remove any part for adjustment or repair. The travel gears are machine cut, heat treated, case hardened and run in grease.

The Speeder Whirlwind of ⅜ yard capacity, the Speeder 90 of 1¼ yards capacity, and the Speeder B3 of ½ yard capacity are now equipped with crawlers and crawling mechanism of the same type.



Speeder Gasoline Shovel

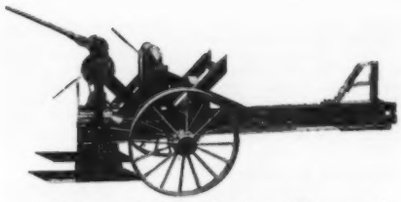
Aluminum Journal Jacks

The Duff-Norton Manufacturing Company, Pittsburgh, has placed on the market a new, light weight car inspector's journal jack. This jack, which weighs approximately 40 per cent less than former models, is designed for general railroad, industrial and contractor usage. Two sizes are available, one having a capacity of 15 tons and the other a capacity of 25 tons. Both models are equipped with the Duff-Norton positive stop safety feature to prevent the lifting standards from becoming disengaged.

The 25-ton jack weighs only 26 pounds, or approximately one pound per ton of capacity; the smaller size jack weighs 19 pounds.

A Hardpan Plow for Hard Work

The Dukelow Hardpan Plow is a two-tooth plow built of heavy structural steel beams and plates. A heavy I-beam tongue acts as a full length shoe when the machine is plowing its maximum depth of 15 inches. The teeth, on 24-centers, are reversible. Two steel wheels carry the plow when running free or when plowing less than maximum depth. This plow does not leave high and low spots—the depth is governed by a ratchet gear and lever, plowing a uniform depth of two to fifteen inches and four feet in width.



The Dukelow Hardpan Plow

The beam acts as a shoe laying flat upon the surface of material being plowed—providing a leverage that will move stubborn hardpan and other materials.

When the plow is in action the wheels idle or float ahead. The bumper on the front of the plow beam is provided for backing the plow when it is necessary to remove stumps, boulders, hardpan and frozen earth. The hitch on tractors is higher than the plow beam—thus eliminating any unnecessary maneuvering in backing. A steel cable is the only necessary connection from the plow to the tractor, giving plenty of room for turning or maneuvering from any point into action.

Slopes can be plowed without interference from the wheels. The plow has proven most successful for sub-grading and finished ditching.

This equipment is now manufactured by the LaPlant-Choate Mfg. Co., Cedar Rapids, Ia.

Two-Way Side Dump Body for Highway Shoulders

The Eagle Truck Body & Mfg. Corp., Auburn, N. Y., manufactures a type of body very useful for certain types of highway work, such as building road shoulders and repairing highways and driveways. The body will dump either to the right or the left. It is built of seasoned hardwood lined throughout with 16-gauge steel. The sides are made in the form of drop gates, hinged at the bottom in order to clear the load over the rear wheels, fenders and running board.

The Eagle Side Dump Wagon

Tires, Truck and Car

165. Solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawler

168. "High Clearance," "Caterpillars in Mines, Quarries, Clay Plants and Pits," "The Caterpillar for Industry," "The Caterpillar for Railroads," "For the Earth Mover," are publications of the Caterpillar Tractor Co., Peoria, Ill.

169. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Wheeled Scoops

190. The WARCO wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in Bulletin No. 3102 issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt Heaters

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connery & Company, Inc., of Philadelphia.

202. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil. wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Highway Mowers

217. A new Motor Sickle Highway Mower, cutting from eight to twenty miles per hour, has been designed for mowing highways. Has a cruising speed while not mowing up to fifty miles per hour over smooth surface roads. Full details on construction and operation from Rawls Mfg. Co., Streator, Ill.

Surface Heaters

218. The new "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is fully described and illustrated in Bulletin 16 just issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material may be obtained from the National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems, will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Masillon, Ohio.

Culverts—Corrugated Metal

238. A new 24-page, well-illustrated catalog, listing the advantages that follow the use of Armco corrugated iron culverts and containing complete instructions for ordering and installation has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Write for Culvert Catalog No. 6.

Expansion Joint for Pavements

251. Full information on the use of Expansion Joints in pavements, bridges, pools, walls and other concrete work, including best installation methods, may be obtained from The Philip Carey Company, Cincinnati, Ohio.

Jacking Method

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. A new catalog, "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials

267. "Mixed-in-Place Construction with Tarmac." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products is now ready for distribution. Recently published by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Material Handling Buckets

280. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Sand and Gravel Buckets

290. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Garbage and Refuse Disposal

304. The Holzbog line of sanitary wagons especially designed for low cost collection of wet or dry garbage and refuse is fully described and illustrated in a 16 page catalog published by Geo. H. Holzbog & Bro., Jeffersonville, Ind.

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Fences

347. A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro. Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

Late Engineering Developments

A Torch of Many Uses

After considerable experimental work, the Mohawk Asphalt Heater Company, Schenectady, New York, has developed a special torch outfit which has been very successful in the destruction and elimination of Psychoda flies, their larvae and pupae, as well as other pests that infest sewage disposal plants.

It is used also in the destruction of the many pests that infest the ground in pens of fox farms, chicken runs, etc. By using this special torch outfit a considerable saving is effected, as it is not necessary to renew the dirt already in the pens and runs.

Morris M. Cohn's article in this issue, "The Filter Moth Fly and the Flame," gives a very complete description of the use of this torch outfit in

The Hotstuf Pest Torch

destroying Psychoda flies that infest sewage disposal plants.

The torch outfit may be put to many other uses, such as weed burning, killing grass, thawing and drying, and for any other requirement where a quick, intense flame will serve.

A New Hydraulic Packing

The Diamond Rubber Company, Akron, O., announces a new product, known as "Rubber Crimps," or "U" Type Hydraulic Packing, for service on hydraulic rams and presses. The new packing is made in rings of standard sizes, with a "U" shaped cross section. The rubber is especially compounded to resist oil, completely eliminating this source of trouble. It is covered almost completely with a layer of fabric, which adds considerable strength, and helps to maintain the ¼" flare at the bottom. When there are worn or imperfect parts in the ram, the rubber packing with its flare works much more satisfactorily than any other kind.

This packing has the following important advantages: Very low cost; suitable for use with pressures up to 3,000 pounds and more; not affected by the heat generated in an hydraulic press; wears very slowly and evenly; it fits snugly against the ram at all times, making an absolute seal, even when the ram is imperfect; thickness vertically through center is ¾"—twice that ordinarily used, which serves to stiffen the flare, and increase the strength and life of the packing; will not dry up when a press is idle; ideally adapted for all sizes of rams, and can be furnished in any standard diameter.

Haiss Popular Price Stockpile Loader

In the belief that there are in existence today many stockpile loading jobs which do not require the full power and capacity of regular Haiss models, the George Haiss Manufacturing Company has designed a loader especially for average stockpile loading requirements—a powerful, high-speed machine which can be sold at very moderate cost.

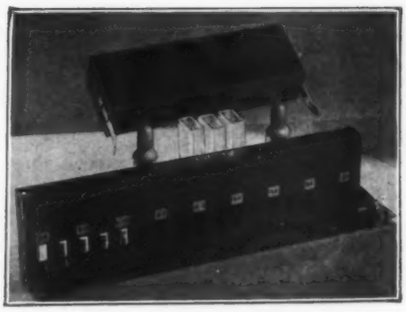
The net weight of the loader is 13,600 lbs. It is manufactured with every type of discharge equipment. The George Haiss Manufacturing Company, Inc., at 141st Street & Canal Place, New York, will send you the Model 50 Bulletin on request.

New Chlorine Comparators

W. A. Taylor & Co., 872 Linden Ave., Baltimore, Md., has developed and recently placed on the market the Enslow Slide Chlorimeter, Taylor Swimming Pool Set, and Combination Swimming Pool Set, for control of chlorine and pH in water, sewage, industrial wastes, swimming pools, etc. All these sets are similar in construction and method of operation. Each consists of two principal parts—the slide and the base. The slide is a Bakelite case 10 x 2.75 x 6.25 inches. It contains 9 color standards representing different amounts of chlorine or pH values, and 8 ampoules of distilled water, the ampoules of water alternating with the color standards.

The Enslow Slide Chlorimeter contains 9 chlorine standards representing 0.0, 0.1, 0.15, 0.2, 0.3, 0.4 0.6, 0.8, 1.0p.p.m. of chlorine. A determination consists in only 3 simple operations. The chlorine content is read directly from the values on the front of the slide.

The Taylor Swimming Pool Set is similar in all respects to the Enslow Slide Chlorimeter except that the slide is divided into 2 sections. The left section contains 5 phenol red standards (6.8, 7.2, 7.6, 8.0, 8.4) for pH determinations, and the right section 4 chlorine standards (0.0, 0.2, 0.5, 0.8 p.p.m.) for chlorine determinations. The base contains 1 vial each of orthotolidine and phenol red solution.



The Taylor Chlorine Comparator

The Combination Swimming Pool Set consists of one complete Enslow Slide Chlorimeter and an additional slide containing 9 phenol red color standards (pH 6.8, 7.0, 7.2, 7.4, 7.6, 7.8, 8.0, 8.2 8.4). This set allows more precise control of both chlorine and pH than is obtained with the singie slide set.

Flush Type Marker Light

For outlining airport runways and indicating by means of distinctive colors particular runways on which planes are to land or take off, a flush type marker light has been developed by the Westinghouse Electric and Manufacturing Company, Edgewater Park, Cleveland, Ohio.

This unit offers no obstruction to a plane passing over it. The maximum projection above the field is only ¾ of an inch. The units are available with lenses of several different colors, in order that they may be used for controlling traffic on multi-runway air-

Flush Type Field Marker

ports. Green indicates the runway for taking off; amber is used to indicate the taxiing lanes and to outline the center circle on a field; and clear lens units are used for boundary lights only.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. The new Type "S" Frink Sno-Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Callon Iron Works and Mfg. Co., Galion, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Activation and Aeration

390. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

Sewer Joint Compound

404. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight are contained in an illustrated folder just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Pumps—Sewage

410. Non-clog vertical and horizontal sewage pumps are fully described and illustrated in new bulletins just issued by the Dayton-Dowd Co., Quincy, Ill.

411. Full information regarding sewage pumps is given in publication 210, and a large number of sewage pump installations are illustrated and described in publication 193. The American Well Works, Aurora, Ill.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorrco Mechanically-Cleaned Bar Screen.

415. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill., shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants.

Sewer Cleaning Machines

416. Illustrated booklet describing Adjustable Turbine Sewer Cleaners, Self-Propelling Ferret Turbines, Drag Type Sewer Cleaners, Five Types of Sewer Rods, Conduit Rods, Windlasses, Sewer Braces, Sewer Cables. Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc.

417. Turbine Sewer Machine Co., Inc., 5210 W. State St., Milwaukee, Wisc., has issued a 16-page *Price and Shipping Data Sheet* No. A-31. *These sheets give* a wealth of supplementary information to that found in our Standard Catalog or Bulletin 120-A. The Price and Data Sheets with or without catalog sent upon request.

418. "The Expanding Root Cutter and Sewer Cleaning Method" is the title of a recent 32 page booklet prepared by the Expanding Sewer Machine Co., Nappanee, Ind. Profusely illustrated, it gives full details as to methods and equipment needed.

Sludge Bed Glass Covers

420. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds.

Storm Sewers

424. A 24-page catalog, profusely illustrated with actual installations under widely varying conditions, which lists the features that give superiority to flexible corrugated metal construction for storm sewer installations, can be obtained from Armco Culvert Mfrs. Association, Middletown, Ohio. As for the catalog No. 5.

423. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data regarding the use of Toncan Copper Molybdenum Culverts for economical and lasting storm sewers, drainage information, etc., will be gladly sent free upon request. Address Toncan Culvert Mfrrs. Assn., Massillon, Ohio.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature, Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Couplings and Tees

485. A new booklet just issued by Mueller Company, Decatur, Ill., fully describes and illustrates the new line of Mueller Tapping Sleeves, Valves and Drilling Machines for water works officials.

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Jointing Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meters

520. "Niagara and American Water Meters are described in the 36-page catalog issued by Buffalo Meter Co., 2920 Main St., Buffalo, N. Y. Catalog describes the chromium-shell gear train, patented frost bottom, ultra-simple design and other exclusive features."

Meter Boxes

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co., Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala, and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pipe for Subdrainage

549. The benefits following the use of Armco perforated iron pipe for various municipal uses such as golf course, athletic field, and airport drainage; and its various applications in the construction and maintenance of highways and railroads are outlined in the 24-page illustrated catalog entitled, "Armco Perforated Iron Pipe." Catalog No. 4 is obtainable upon request from Armco Culvert Mfrs. Association, Middletown, Ohio.

Pumps, Waterworks

560. Centrifugal pumps for high or low service pumping for waterworks and filtration plants. Bulletins contain interesting installation photos, characteristic curves, etc. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps

561. Double suction centrifugal pumps are described in Bulletin 197; multi-stage centrifugals in Bulletin 200; deep well turbines in Bulletin 211, and a number of municipal pump installations in Bulletin 178. These contain much valuable data. Free on request. The American Well Works, Aurora, Ill.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Screens

576. Link-Belt Co., Chicago, Ill., has issued Book No. 1252, which describes their Water Screens and gives complete technical information about them.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh-Des Moines Steel Co., 3479 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

The DeVilbiss Highway Striping Outfit

A Highway Striping Outfit, which is used for spray-painting a traffic line stripe on public highways and city streets, has just been perfected by The DeVilbiss Company, Toledo, Ohio, manufacturers of spray-painting and spray-finishing equipment. With the spray process a uniform well-coated stripe is laid down much faster and better than is possible with the hand brush method. In addition to cutting painting costs, closed traffic lanes are reopened to the public several hours sooner than was formerly possible.

The DeVilbiss Highway Striping Outfit, Type HS, illustrated in the accompanying photograph, has been developed to meet all conditions of such character. This outfit lays a perfect stripe at a speed of six to eight miles an hour. It stripes in a few hours the distance that can be painted by hand in a day, and removes the danger to men in hand striping. About seven gallons of paint is used for each mile of striping, depending upon pavement.

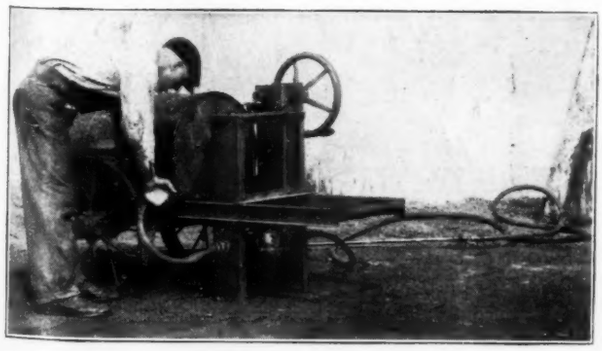
The De Vilbiss Striping Outfit lays a stripe at 6 to 8 miles an hour.

The Type HS Outfit can be attached to either right or left running board or can be used as a trailer from the rear of a truck. While it is substantially built for its purpose, yet it is light enough for one-man handling in loading and unloading and attaching to truck. A special toggle type joint with spring tension frees the striping outfit from truck jars. Road jars are absorbed by the rubber tires on the equipment. In intermittent striping, or in going from one job to another, the outfit can be lifted by chain or rope from the operator's position on the truck, thus permitting the driving of the truck at greater speed between jobs with consequent saving of time.

Loading a Littleford Emulsion Spray Unit

Left—When the drum is in an upright position as shown at left, remove the bung in the head and replace it with the special fitting that is furnished with the spray outfit. This fitting has a syphon tube, self-cleaning strainer and shut-off valve.

The drum is tilted back enough to allow loading lip of truck to pass under it. Be sure that fitting on drum is toward the truck. Drum is then dropped on to cradle and truck is lowered. The operation is much the same as loading an ordinary hand truck.



Left—Suction hose to pump is now connected to the special fitting on the drum. The shut-off valve is opened and the outfit is ready for operation. Be sure to remove the small air-hole plug in the drum head. This is done only in the case of gear pump outfits to prevent the formation of a vacuum in the drum. Right—Outfit in action.

Valves

585. Catalog covering our line of Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines furnished upon request. Also data on "Dart" Unions and Fittings. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

599. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to the use of Toncan Perforated Iron Drains and Culverts for economical and permanent drainage of landing fields, will be sent free upon request. Address Toncan Culvert Mfrrs. Assn., Massillon, Ohio.

Asphalt Bridge Planking

601. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books. No. 125, Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Flexible Joints

611. Bulletin 204 containing 60 illustrations gives complete data regarding uses and specifications of Barco flexible joints for water works, sewage disposal plants, road contractors pipe lines, etc. Just issued by the Barco Mfg. Co., 1800 Winnemac Ave., Chicago, Ill.

Miscellaneous

618. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Municipal Drainage Products

620. A complete line of drainage products which meets the modern municipal need for drainage materials that are quickly installed, safe, and dependable and economical in service is described in the new 24-page, illustrated catalog, "Armco Municipal Drainage Products." A request to Armco Culvert Mfrs. Association, Middletown, Ohio, for Catalog No. 9 will bring you this book free of obligation.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Transits and Levels

630. A complete line of Transits and Levels particularly adapted for City, County and State work is fully described and illustrated in a new 64 page catalog just published by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

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